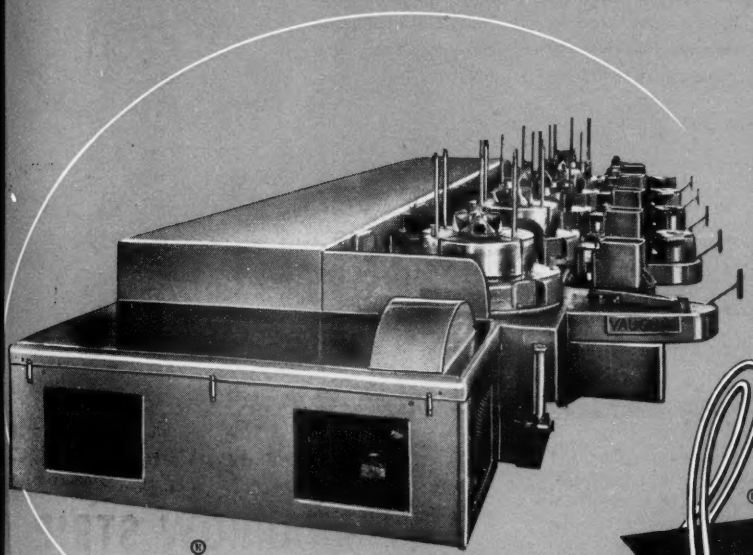
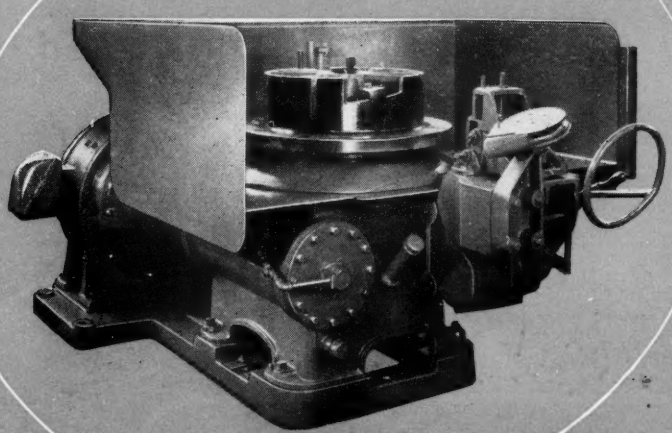
WIRE AND WIRE PRODUCTS

NOVEMBER 1949



MOTOBLOX®

MOTOBLOC®



for MAXIMUM COMPETITIVE ADVANTAGE...

Vaughn®

WIRE DRAWING MACHINERY

. . . *because* maximum speed, maximum flexibility and maximum versatility maintain low operating costs, and support profitable schedules! *Write.*

THE VAUGHN MACHINERY CO.

CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

"Quick on the Draw"
VAUGHN MACHINERY
Profitably Used by Leading Wire Mills Since 1871

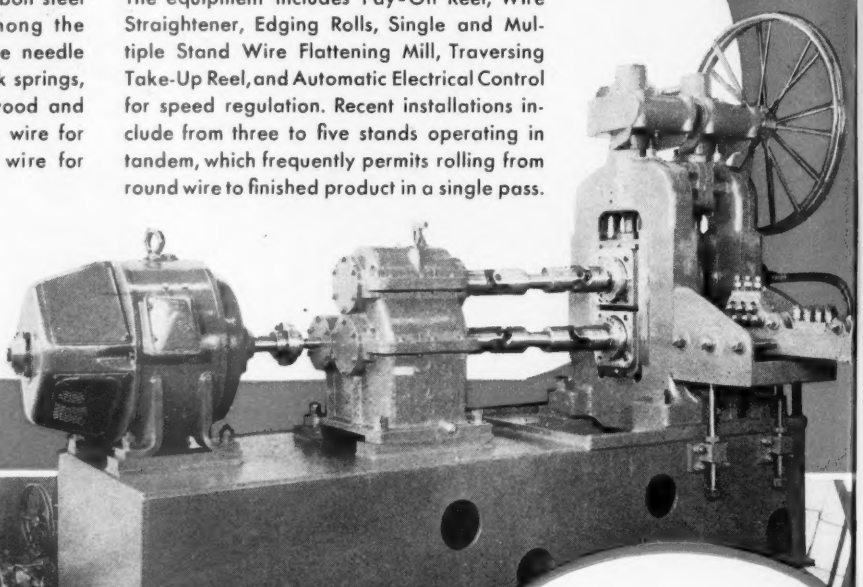
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

WIRE FLATTENING

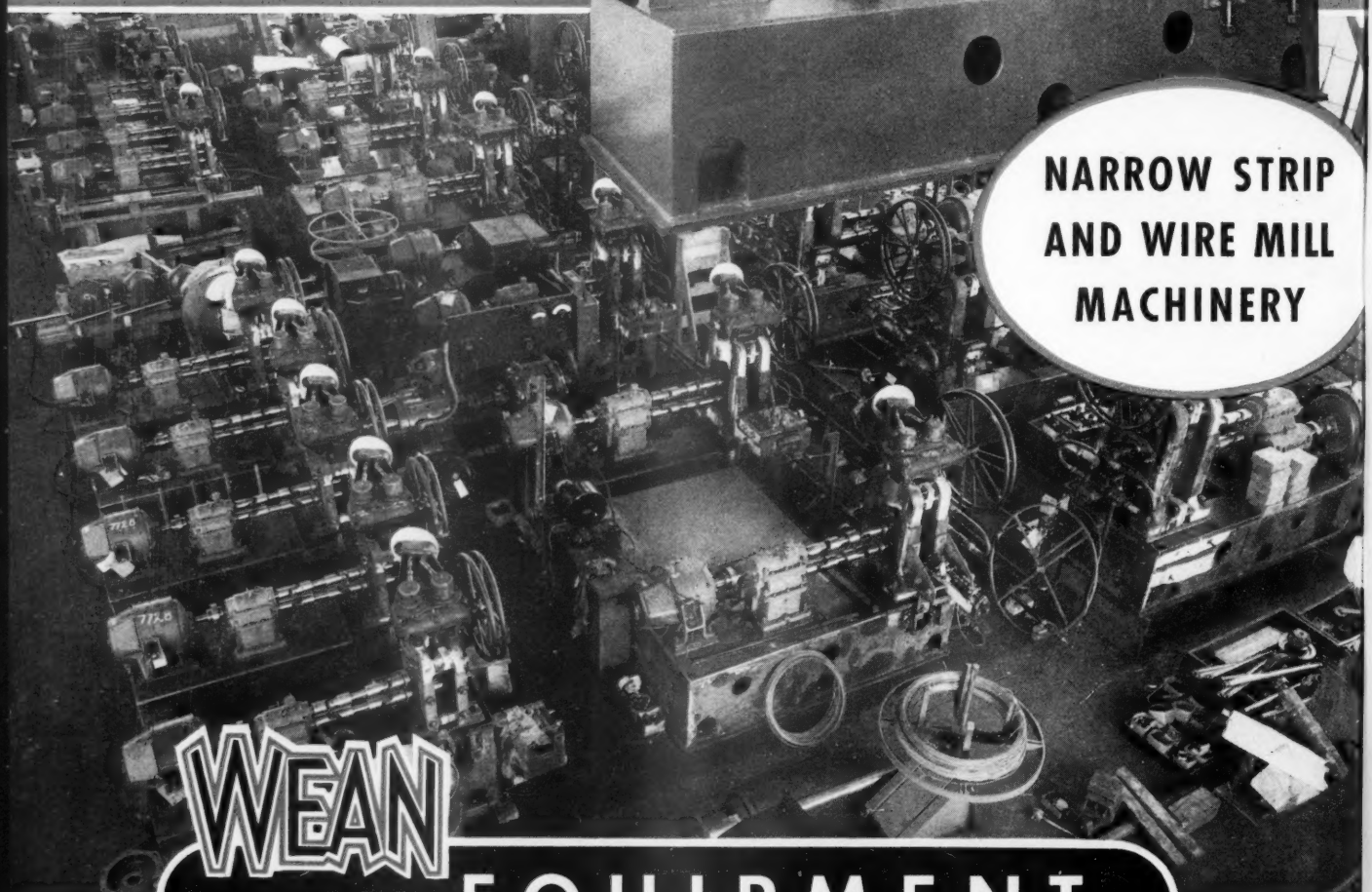
• The cold rolling of round wire in Wire Flattening Mills is an important production Process for producing flat and rectangular cross section wire to closely controlled tolerances in thickness and width. The process is applied to both low and high carbon steel wire and to non-ferrous wire. Among the products produced in this way are needle wire, spring wire for watch and clock springs, umbrella wire, fret-saw wire for wood and metal working, book-binding wire, wire for special steel springs, and copper wire for electrical coils

Wean Equipment Corporation has developed completely modern mills and annealing equipment for this purpose, designed and constructed to produce smoothly finished flat wire of excellent uniformity at high speed. The equipment includes Pay-Off Reel, Wire Straightener, Edging Rolls, Single and Multiple Stand Wire Flattening Mill, Traversing Take-Up Reel, and Automatic Electrical Control for speed regulation. Recent installations include from three to five stands operating in tandem, which frequently permits rolling from round wire to finished product in a single pass.

8" Single Stand Wire Flattening Mill with Wire Straighteners



General view (20 Mills on assembly line)



NARROW STRIP AND WIRE MILL MACHINERY

WEAN EQUIPMENT Corporation

22800 LAKELAND BLVD. • CLEVELAND, OHIO

CARBOLOY'S got something new!

New, long-lasting Carboloy heading hammers—*are now furnished with markings*—to help boost your production

IT'S the best news in a long time for bolt and rivet manufacturers.

Carboloy announces a complete new line of heading hammer nibs, *furnished with any male or female marking, pattern, numeral or letter you specify*. These nibs can be made in all sizes in which plain carbide heading hammers are commonly used.

Here's what they can do for you

Install these amazing new Carboloy hammers on your heading machines, and watch your production records zoom! Here's what a large midwestern cap screw manufacturer reports about these nibs.

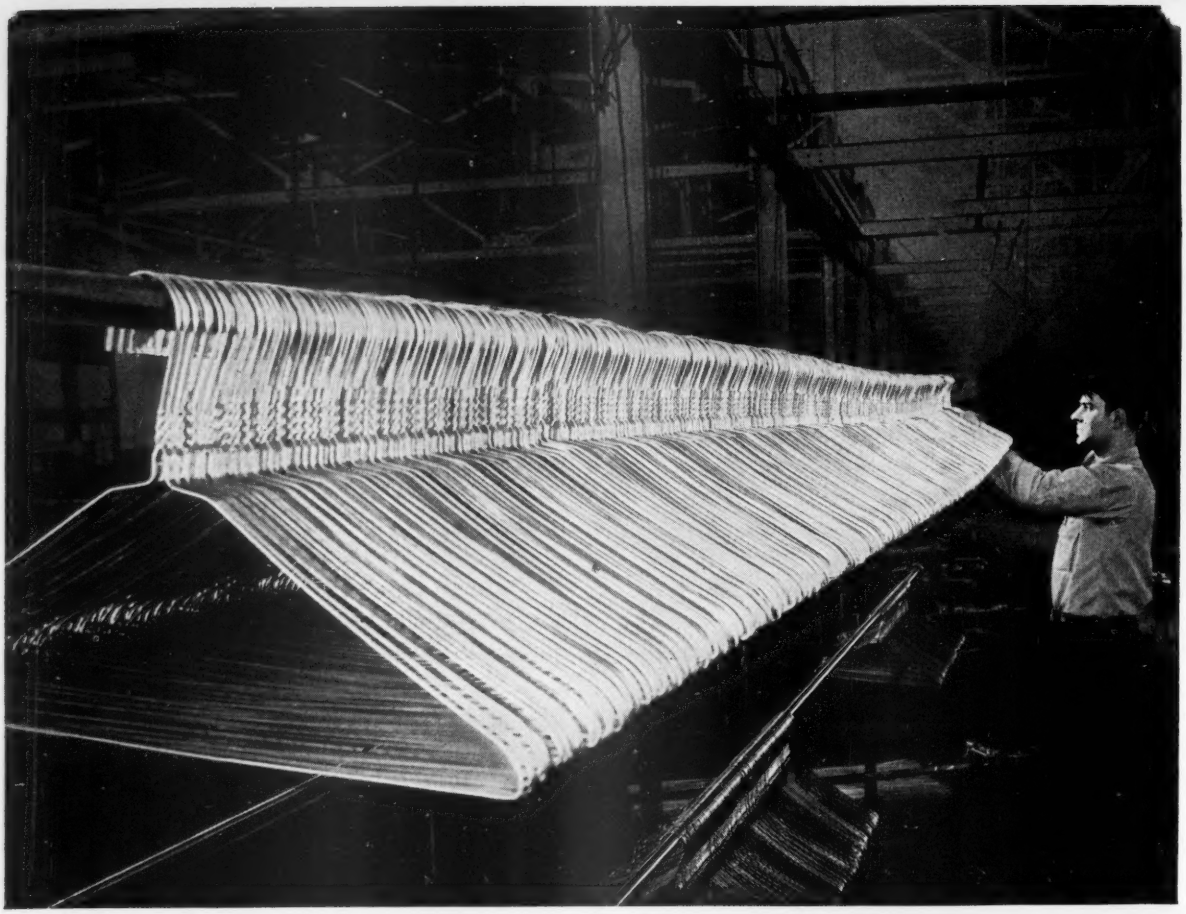
Steel hammers formerly used by this company were replaced by new Carboloy heading hammers. Cap screw limit with steel hammers was 100,000. With the new Carboloy nibs, 900,000 screws have been turned out, with no noticeable wear to date! Original estimate of 1,000,000 limit with Carboloy has been upped to 2,000,000—over 20 times the life of steel hammers!

More good news!

Even when the markings show signs of wear, there's plenty of use left in the Carboloy hammer. Simply regrind it for plain heading operations; it will give you an extra bonus in money-saving performance.

The over-all production savings from these Carboloy heading hammers begin the minute you install them. Take advantage of these savings *now*. For complete information, write Carboloy Company, Inc., 11171 E. 8 Mile Road, Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDE



Another job that wire does best

For compactness, lightness and all-around utility you can't beat coat hangers made entirely of steel wire. In hangers, as in so many other articles, steel wire supplies strength, durability and economy.

Coat-hanger wire is just one of our many steel wire specialties. We furnish it in various sizes and finishes. It is made stiff enough to support the garment, yet tough enough to withstand the severe twisting necessary to form the hanger.

Steel wire has thousands of useful applications, most of them calling for special properties in the steel. The wire you need is likely to be a grade and quality we've furnished recently. Perhaps you would like to have one of our technical men assist your organization in developing better wire products.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ **BETHLEHEM WIRE** ★

WIRE & WIRE PRODUCTS, Vol. 24, No. 11, November, 1949. Publication Office, at One Sherman Ave., Jersey City 7, N. J. Executive Office, 300 Main Street, Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secy. and Treas. Subscription price: U. S. $5.00; Canada, $5.00 per year; 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, January 10, 1949, at the Post Office, Jersey City, N. J., under Act of March 3, 1879.

How clean is a whistle?

YOUR wire will come to you "as clean as a whistle" if you request your mill to furnish it coated and drawn with Magnus Metalcoat #267.

If anything is hard to clean from steel wire, it's *lime!* Limed wire is inclined to rust, too, which is another cleaning problem.

Why should you have to clean your wire before you can weld it, plate it, galvanize it, lacquer it, or use any other special finish? It just adds to your manufacturing costs.

So, whether you manufacture brads or bird cages, coat hangers or coils, staples or spokes... *whatever* your product may be, ASK YOUR WIRE MILL TO FURNISH YOUR STEEL WIRE COATED AND DRAWN WITH MAGNUS METALCOAT #267!

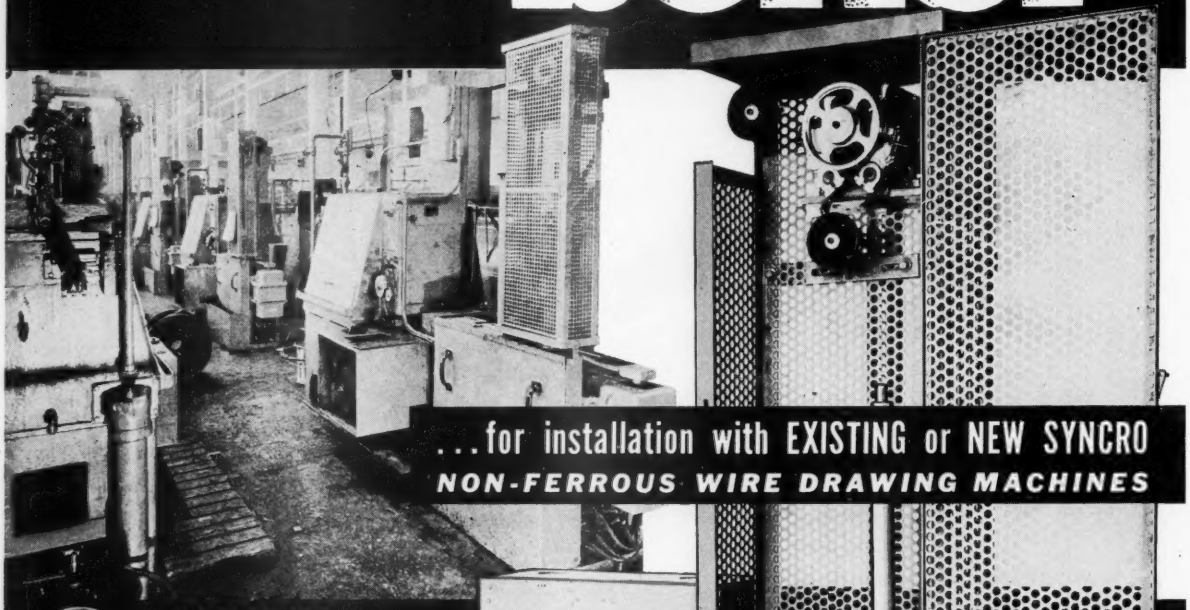
No other coating is so easy to remove. Just give your Metalcoated wire a hot bath in plain water, dry it quickly, and then go ahead and finish it your way.

Your wire suppliers *want* to please you, and now that the steel shortage is pretty well licked, they are in a better position to give you the kind of wire you want, when you want it, and the way you want it.

On your next order, SPECIFY MAGNUS METALCOAT #267!

Metal Coating Division
MAGNUS CHEMICAL CO., INC.
Garwood New Jersey

so much better



...for installation with EXISTING or NEW SYNCRO
NON-FERROUS WIRE DRAWING MACHINES

WORLDWIDE INSTALLATIONS BEING MADE...

...because of these features:

● NO OVERHEAD CRANES ● NO HEAT DISSIPATION TO REELS, COVERS OR AIR SPACES ● RESISTANCE ANNEALING—NO KILOWATTS WASTED ● NO POWER NEEDED FOR LOADING, UNLOADING, OR CONVEYING ● NO TIME LAG—HANDLES 5,000 FEET PER MINUTE ● CONTROLLED ELONGATION ● TAKES ALL STANDARD SIZES ● VISIBLE OPERATION ● PRODUCES CLEAN AND BRIGHT ANNEALED WIRE ● DESPOOLS PERFECTLY ● NO DISCOLORATION OR STICKINESS ● TAKES STANDARD METAL SPOOLS OR REELS ● TRANSFORMER CONTROL—TAPS COVER FULL SIZE RANGE ● ACTUAL ANNEALING COST ONLY IN CURRENT USED ● LABOR SAVING—NO REHANDLING ● SAVES FLOOR SPACE AND INVESTMENT COST ● COOLING WATER CONTINUOUSLY RECIRCULATED—TUBE LEVEL AT FIXED HEIGHTS ● PROPER GROUNDING INSURES OPERATING PERSONNEL SAFETY

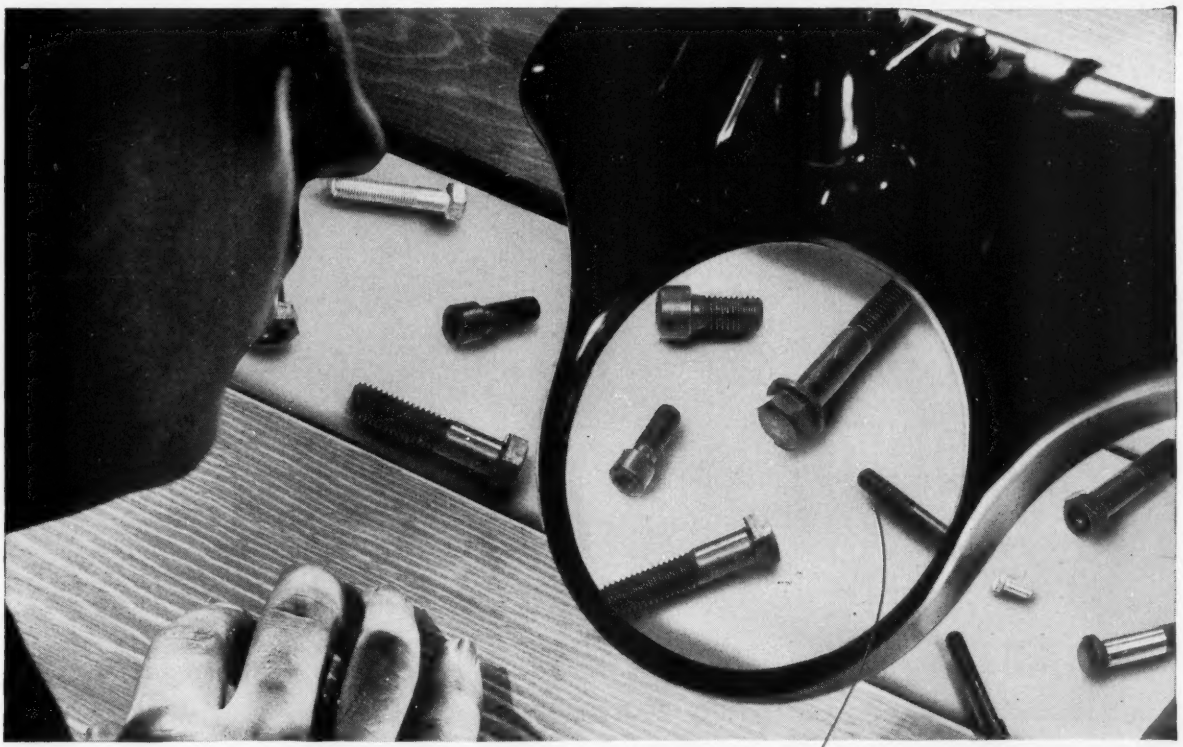
EXCLUSIVE with SYNCRO
PATENTED STEAM SEALED, RECIRCULATING CONSTANT LEVEL ANNEALING CHAMBER

SYNCRO CONTINUOUS ANNEALERS

SEND US YOUR PROBLEMS
WE HAVE THE ANSWER

SYNCRO MACHINE COMPANY · PERTH AMBOY · NEW JERSEY · USA
AFFILIATED COMPANY • WINGET-SYNCRO, ROCHESTER, KENT, ENGLAND

Quality control provides
FREEDOM FROM PHYSICAL DEFECTS
in U·S·S Amerloy Wire



THROUGHOUT its production, CONTROL OF QUALITY is the watchword in the manufacture of U·S·S Amerloy—a high quality alloy heading wire. This careful control means that Amerloy is remarkably free from physical defects; thus providing a high production rate for you and reducing your tooling problems.

This quality control pays other dividends too. It provides a uniform surface texture. Uniform color. Accurate dimensions. And it means that your requirements for hardness, strength, stiffness and workability will be met more exactly.

Write or call today for complete information on U·S·S Amerloy. This wire is available NOW for shipment in the quantity you need.

If you use Alloy Wire...use
Amerloy

USS

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL

Are Your SHAPE DIES Expensive?

Expensive to buy, expensive to use, expensive to maintain?

Then look into Eastern Carbide shape dies! It costs you nothing to get the facts. We are at your service.

New design and manufacturing techniques make possible the production of shape dies that will greatly reduce your costs—for dies and on shape wires.

Your own interest in getting costs down to an absolute minimum dictate the desirability of getting information on Eastern Carbide dies and we invite you to write, 'phone or wire for details on what we have accomplished in this direction.

Please address inquiries to

EASTERN CARBIDE CORPORATION

Telephone: NEW ROCHELLE 2-6630

909 MAIN STREET NEW ROCHELLE, N. Y.

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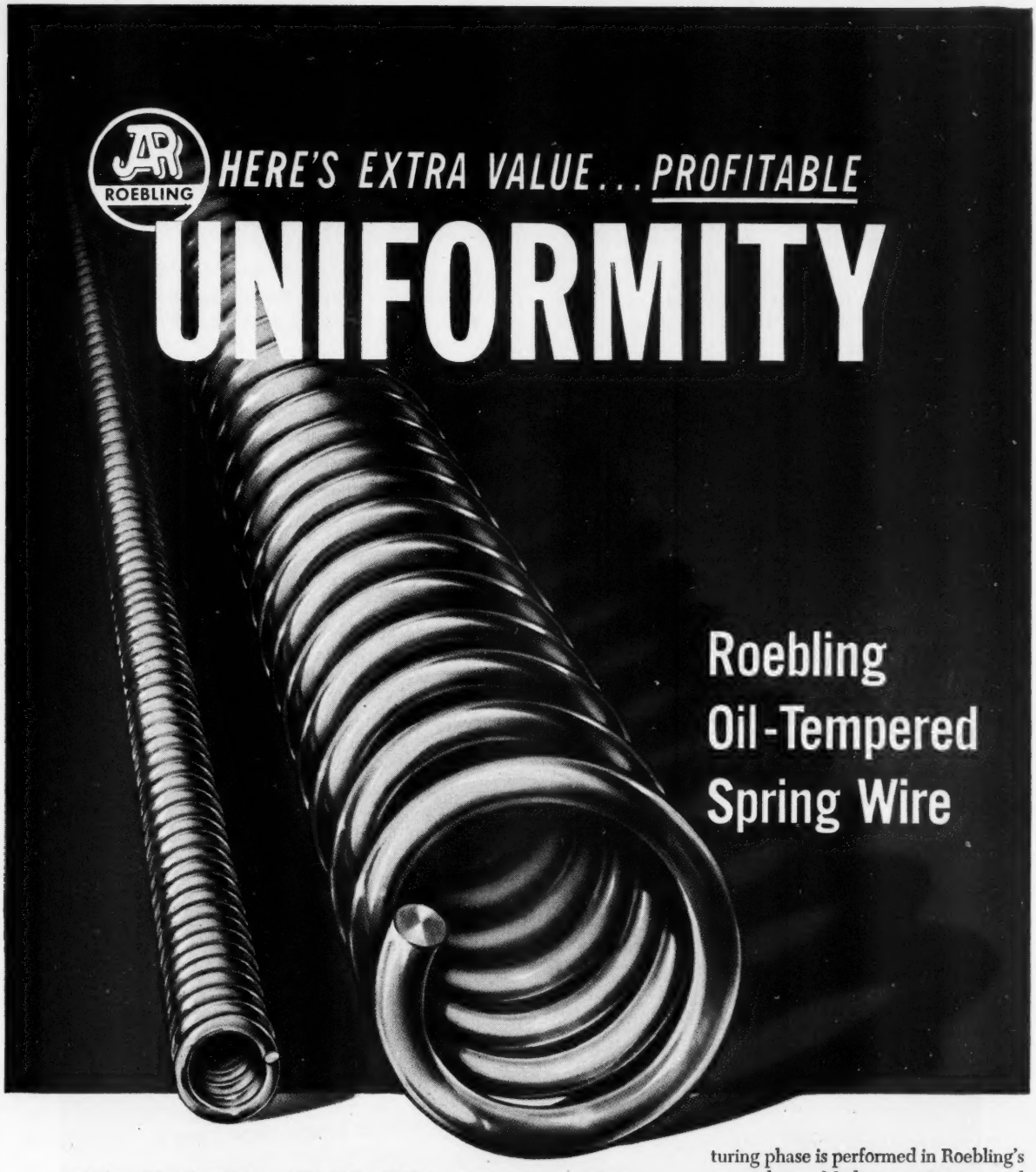
Distributors of HYPREZ Diamond Compounds for MODERN Ripping and Polishing Practices with Superior Finish.

Eastern Distributors of WENDT-SONIS Carbide Cutting Tools.



CUTS MACHINE STOPPAGES AND REJECTS

PRODUCTION GOES INTO HIGH with Roebling Oil-Tempered Spring Wire. Every inch is just like every other inch . . . same gauge and grain structure . . . same strength, hardness and finish. And more than that, the dependably uniform analysis of Roebling Spring Wire enables you to maintain your specified quality standards without variation.

Roebling Oil-Tempered Spring Wire, in the higher carbons, is available in all standard sizes. From making the steel to the finished product, every manufacturing phase is performed in Roebling's own plants. Modern equipment and techniques assure wire of topmost quality . . . and it's available now!

Your Roebling Field Man will be glad to help you select the right wire—round, flat or shaped—for top performance and economy in your own products. John A. Roebling's Sons Company, Trenton 2, New Jersey.

WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ *Boston,* 51 Sleeper St. ★ *Chicago,* 5525 W. Roosevelt Rd. ★ *Cleveland,* 701 St. Clair Ave., N. E. ★ *Denver,* 1635 17th St. ★ *Houston,* 6216 Navigation Blvd. ★ *Los Angeles,* 216 S. Alameda St. ★ *New York,* 19 Rector St. ★ *Philadelphia,* 12 S. 12th St. ★ *Pittsburgh,* 855 W. North Ave. ★ *Portland, Ore.,* 1032 N. W. 14th Ave. ★ *San Francisco,* 1740 17th St. ★ *Seattle,* 900 First Ave.

ROEBLING

☆ *A CENTURY OF CONFIDENCE* ☆

HUDSON WIRE COMPANY

PRODUCERS OF FINE WIRES IN ALL METALS

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver (10%, 18%, 30%), Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloys, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity Electric Wire.

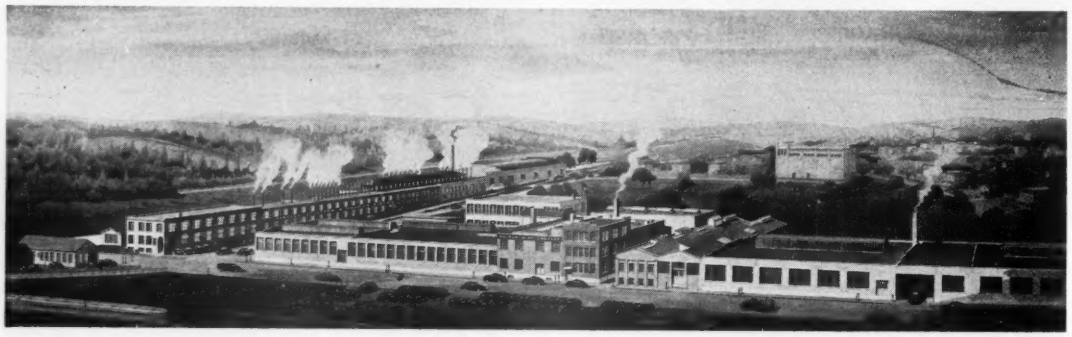
Cadmium, Nickel Silver (10%, 18%, 30%), Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

Look for the name — **HUDCO** — A guarantee of quality

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Write for Prices and Samples • Let Us Quote on Your Requirements



"HUDCO" PLANT AT OSSINING, NEW YORK

HUDSON WIRE COMPANY

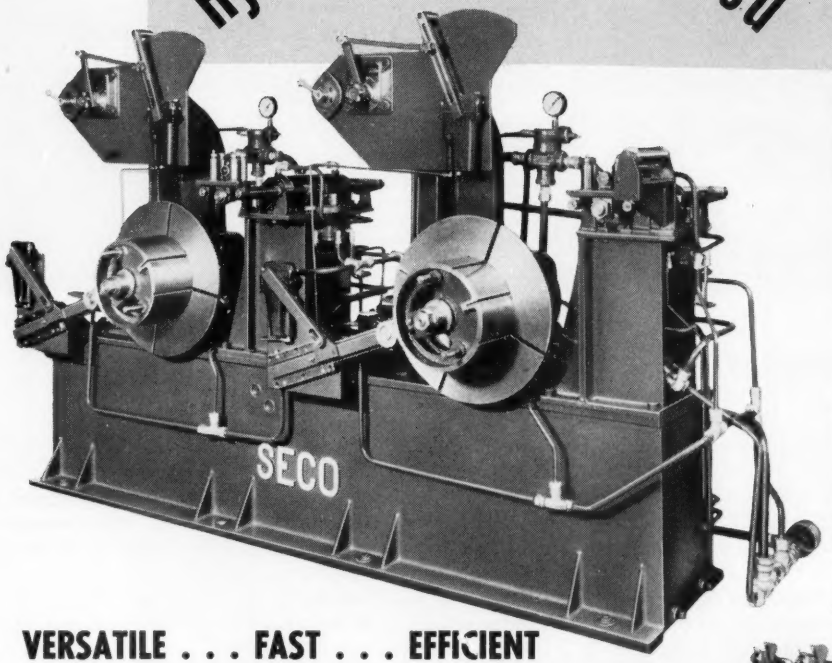
Established in 1902 — Successors to Royle & Akin

OSSINING, NEW YORK

They Said It Couldn't Be Built . . . but We Did It!

SECO *Presents*

ITS NEW Hydraulically Operated WIRE SPOOLER



- Revolutionary Design!
- Quick Speed Adjustment!
- Controlled Tension!
- Adjustable Traversing!
- High Accuracy!

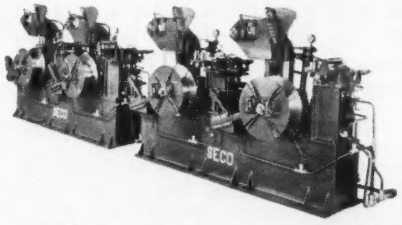
VERSATILE . . . FAST . . . EFFICIENT

ENTIRELY NEW in DESIGN and ENGINEERING

SECO, with its new Hydraulically Operated Wire Spooler, presents a revolutionary development in efficient wire spooling. An infinitely variable speed range from 0 to 4,000 FPM—accurate, adjustable traversing for wire gauges varying up to 20:1—controlled tension—and a new, original design that gives sensitive, fully adjustable operation—are among the superior features of this new Spooler.

A new rider-roll control, developed by SECO, automatically compensates for increase in coil diameter—assuring a constant linear spooling speed.

Each Spooler is engineered to solve your present production problem—with built-in flexibility to meet future requirements. Construction is rugged and compact—designed for economy, safety and ease of maintenance. Write today for full details and operating data.

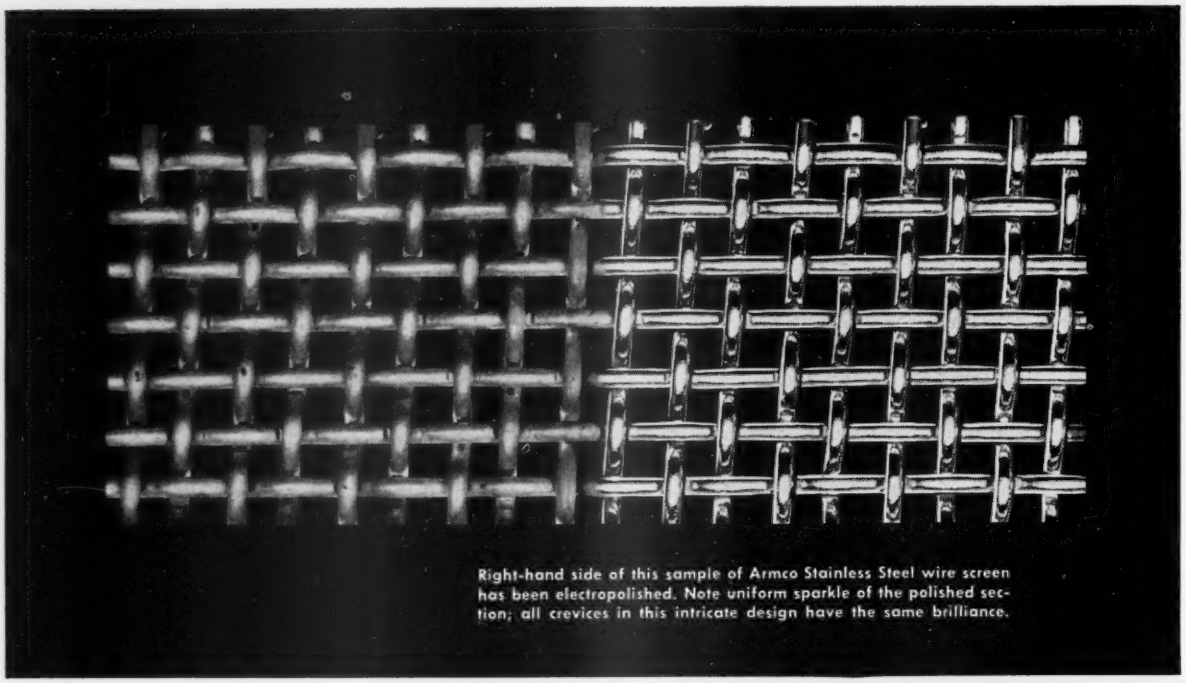


The Four Spindle Duplex Traverse Reel installation shown above handles tinned copper wire at speeds from 150 to 600 FPM. Wire sizes range from .100" thick by .200" wide to .045" thick by .500" wide. Wire is coiled on collapsible blocks, 10" diameter, 6" wide with 18" flanges for 250 pound coils —or on spools with 14" diameter cores, 6" wide with 24" flanges holding 450 pounds of wire. Tension from 75 to 150 pounds is regulated by a pressure control valve.

STEEL EQUIPMENT CO.

2890 EAST 83rd STREET • CLEVELAND 4, OHIO

SECO



Right-hand side of this sample of Armco Stainless Steel wire screen has been electropolished. Note uniform sparkle of the polished section; all crevices in this intricate design have the same brilliance.

This Polishing Method Brightens Your Future

Electropolishing is the simple, low-cost Armco method of polishing stainless steel. Comparing cost of plating and polishing other metals, the saving in electropolishing stainless steel is often more than enough to offset its higher cost. This may make stainless steel your *most economical choice* for polished wire products.

Of course, you are also vitally interested in the sales appeal of your wire products. Here again Armco Stainless Steel gives you the advantages of a superior material in highly competitive markets. It is a naturally beautiful and corrosion-resisting metal *all the way through*. There is no plating to chip or wear off.

HOW ARMCO ELECTROPOLISHING WORKS

This method is the reverse of electroplating because metal is removed. But metal loss is very low—ranging from 0.0002 to 0.001 inches, depending on surface, treatment time and current density. At the same time it cleans the surface of foreign substances and embedded particles—even removing discolorations caused by roller seam or spot welding. Electropolishing is invaluable in polishing intricate wire products.

There is less investment in equipment with Armco Electropolishing. A power source, processing and rinse tanks are all you need. Operating costs are low and no skilled labor is required.

WANT THE DETAILS?

To find out whether you can profitably convert your wire products to stainless steel and the Armco Electropolishing method, just fill in and mail the coupon below. Armco Steel Corporation, 4159 Curtis Street, Middletown, Ohio.

Export: The Armco International Corporation.

ARMCO STEEL CORPORATION

ARMCO

MAIL THIS HANDY COUPON

Armco Steel Corporation, 4159 Curtis Street, Middletown, Ohio
Send me more information about Armco Stainless Steel and the new electropolishing method. We make _____ (product or part)

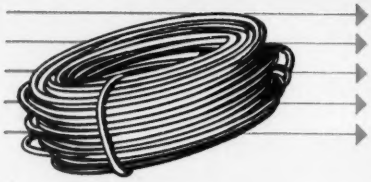
Name _____ Position _____

Firm Name _____

Street Address _____

City _____ Zone _____ State _____

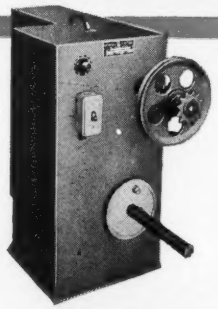
HOW TO TRANSFORM THIS



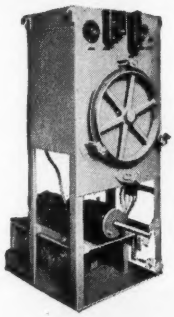
INTO THIS*

Quickly and at Less Cost

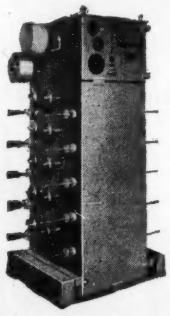
***OR REEL TO REEL**



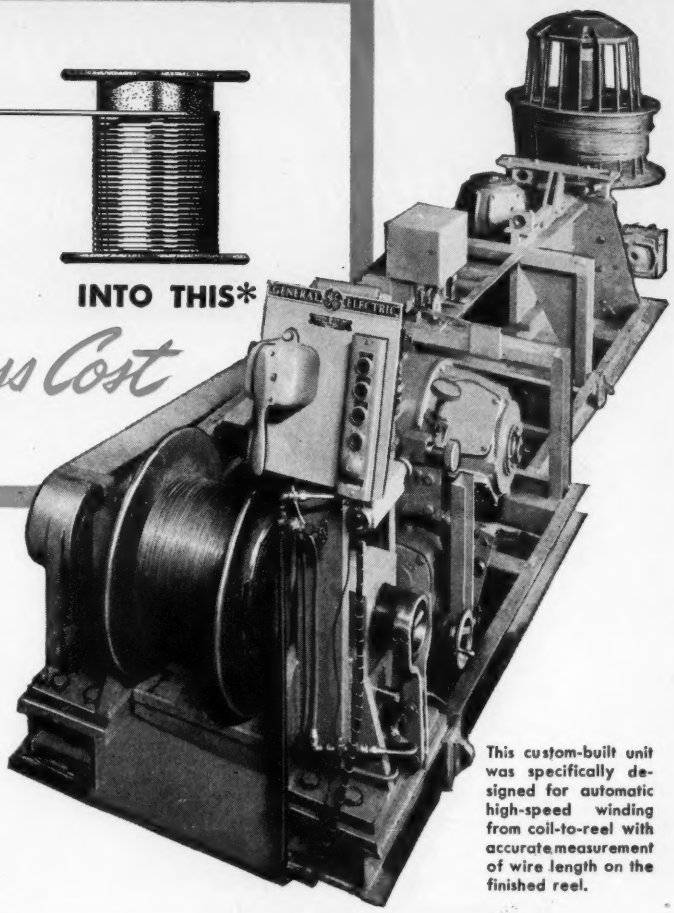
Individual winding heads with their own traverse mechanism. Can be combined with a capstan in any number to comprise a multi-head equipment.



Wire speed and tension is maintained automatically by electronic controls on this combination capstan and pickup mechanism.



Multi-head machines are available with capstan, gang-traverse mechanism, winding heads, and speed and tension control installed in a single unit.



This custom-built unit was specifically designed for automatic high-speed winding from coil-to-reel with accurate measurement of wire length on the finished reel.

Install G-E automatic WIRE-WINDING EQUIPMENT

There's a faster, better way to wind or rewind wire from coil-to-reel or reel-to-reel—with General Electric's new completely electrified automatic wire-winding equipment.

"Custom-tailored" from basic components to conform to your particular requirements, these complete equipments not only expedite wire-winding operations, but also make an invaluable contribution to your subsequent production by putting wire in more easily usable form. And their compact, "unit design" means important savings in valuable floor space.

Yes, if you wind wire in any shape or form (and most sizes) you can advantageously use G-E wire-winding equipment. To start the ball rolling on applying one or more of these equipments to your operations, simply contact your nearest G-E office—or write Sect. 720-4, Apparatus Department, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in

GENERAL ELECTRIC

720-4

fine high-pressure hydraulic equipment FOR THE LEAD CABLE ENCASING INDUSTRY

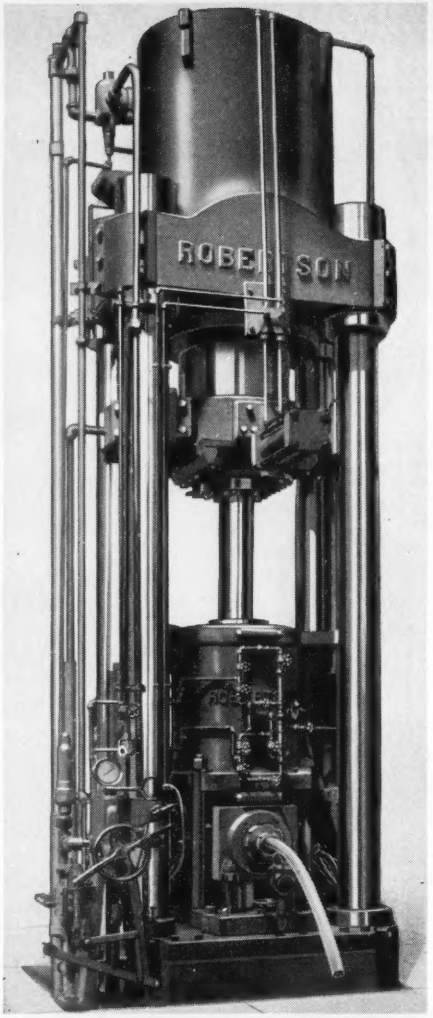
. . . used by leaders the world over

Quality of Finished Product . . . Heart of the Robertson Press is the quick-change lead encasing die-block . . . which forms a close-fitting lead sheath of maximum density and uniformity.

Quality of Performance . . . the Robertson Press helps increase output with minimum operating and maintenance costs.

Quality of Construction . . . Robertson craftsmen are skilled specialists in the design and manufacture of high pressure hydraulic equipment . . . this individual craftsmanship assures a "custom-built" machine "tailored" to your exact requirements.

For over 91 years, Robertson has been a leader in its specialized field: producing fine high pressure hydraulic equipment . . . used by leaders throughout the world. Robertson engineers will help you solve your lead encasing problems. Write us today.



CABLE LEAD ENCASING PRESS

JOHN Robertson COMPANY INCORPORATED

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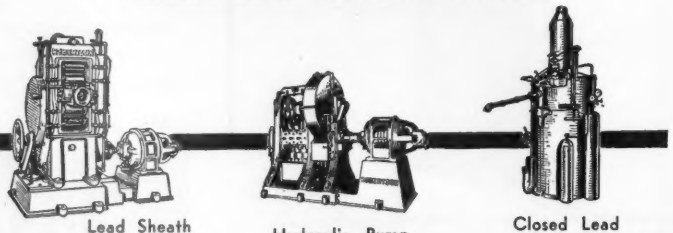
Designers and Builders of all Types of Lead Encasing Machinery

Since 1858



Lead Sheath Stripping Machine

Hydraulic Pump

Closed Lead Melting Pot

How to have a hearty appetite when Thanksgiving rolls around

Ever notice how much better you feel when things are running smoothly at the mill or plant? No question about it, the daily problems you're confronted with have a habit of hitting you below the belt — no matter how rugged your constitution may be. . . .

The only point we're really trying to make here is that we hope you'll *"eat hearty"* when Thanksgiving rolls around — and we think you'll stand a better chance for celebrating if you're using wire drawing lubricants by STANDARD. . . .

For these special-purpose compounds are *tailor-made* to give you faster, better draws . . . *mill-tested* to save you time, trouble and money. So if you want smoother going at the mill (and a heartier appetite at home), just sing out for STANDARD.

Got a special problem? A note to our technical department will bring you some quick and workable answers!

Standard's wire drawing compounds will produce the finish you require on all grades of steel, copper, or brass: — lime bright, extra bright, dull-coated; or special finishes for welding, lacquering, enamelling or plating.

STANDARD SERVICE CENTERS

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Los Angeles 21, California

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San Francisco, California

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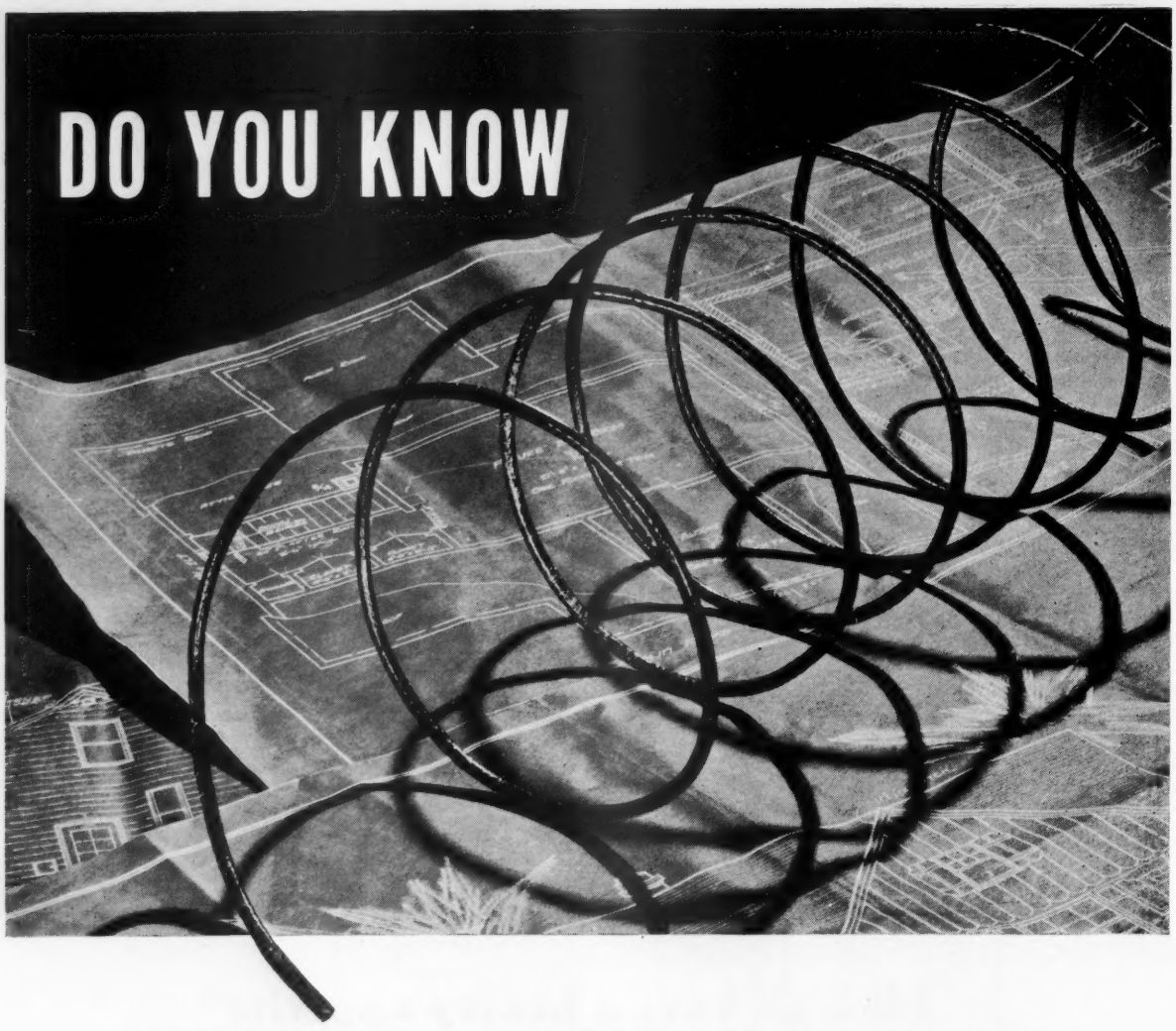

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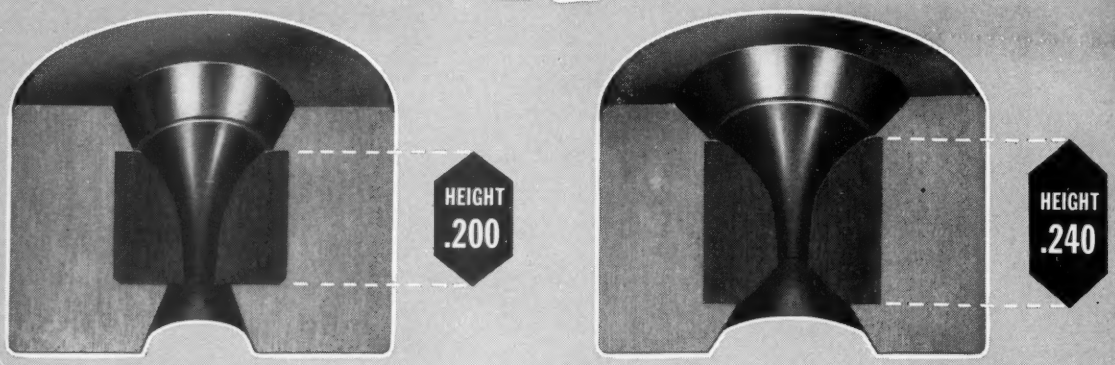

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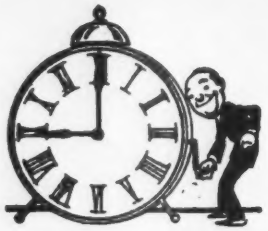

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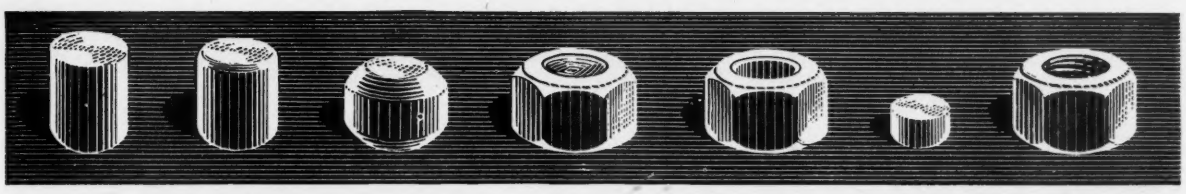

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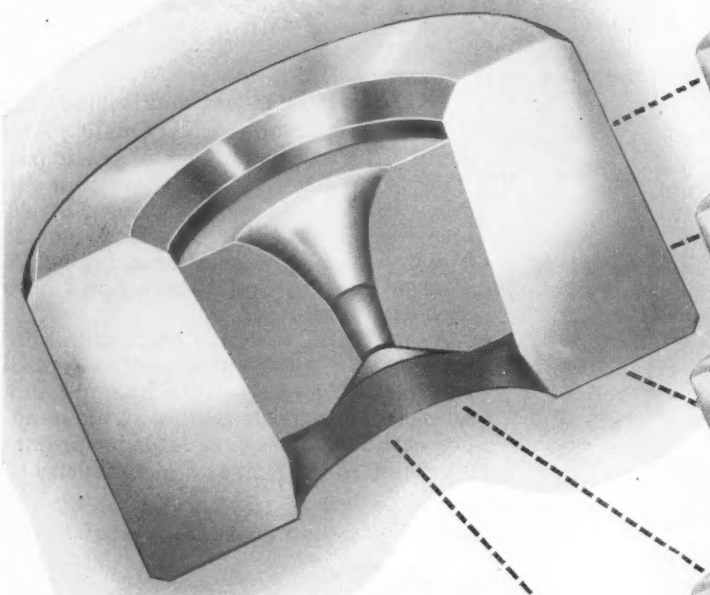

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The Wire Outlook

In this era of major strikes, one may well be forgiven for wondering toward what we are heading. While the steel strike to this date shows no indication of settlement, observers expect that pressure will soon be brought to bear by the Administration, with the probable result of forcing the steel companies to accept the non-contributing principal for pensions. A long strike will be a major set-back to the recovery so well started. No one wants it nor can we afford it. Strikes are costly and senseless. The attitude of the labor union heads in negotiations savors strongly of Russian technique—they are perfectly willing to "negotiate," provided industrialists accept their terms. What the "big four" have proposed will lessen present contributions by labor toward insurance benefits substantially. For instance, an employee with dependents has been contributing $6.55 per month. The new proposal would cut this to $3.00 for benefits as good or better than at present, which include hospitalization, accident and health insurance, surgical service and group life insurance.

In the second week of the strike, the steel output rate had fallen to 9.3% of capacity. Most concerns have stockpiles of steel to carry them for a few weeks, but should the strike continue beyond the point where supplies are available, the national income and the purchasing power of the public are sure to be seriously curtailed. Granting that the dispute can be composed reasonably soon, the balance of the year and 1950 should maintain a fair semblance of prosperity.

In the coming year there will be dips here and there as the adjustment process continues with a small continuing downward trend in prices. These dips, however, should not be construed as the beginning of another depression, since basic conditions warrant a generally good level of business activity.

Although we may not observe the full effects of foreign currency devaluations for some time, it is the hope of those countries that it will spur their export business. Devaluation, nevertheless, is a temporary palliative and does not cure other ills that grow out of inept bureaucracy, work restrictions, stifling taxation and inefficient production. Last year we exported 5% of our total production and imported an equivalent of 3%. Obviously, we cannot go on building up an unfavorable trade balance for which our customers cannot pay in dollars. Whatever the outcome of the experiment, cheaper goods from foreign sources are certain to prod domestic manufacturers into greater efforts to cut our own production costs further.

Conference agreement on the Basing Point Bill was arrived at before our Convention and it was hoped that the bill would be passed before adjournment. However, while it was passed by the Senate, on motion, final action was deferred until Congress re-convenes. It seems strange that our Solons have such difficulty in arriving at a conclusion that to the man in the street seems so obvious. A continuation of the present F.O.B. system is certain to choke off competition and necessiate many expensive and painful shifts of workers and manufacturing establishments toward the big steel centers.

Up to the point of the steel strike, shortages seem to have been pretty well eliminated. The demand for domestic appliances had resumed. Nails, barbed wire and fencing were in good supply. Buying of wire and wire products had started up strongly, some of it doubtless to build inventories, with upholstery spring shipments the heaviest in years. Screw and stapling wire demand has been good and rod supplies ample. Armored wire cable and steel telephone wire were among the active items.

We are likely before long to feel the impetus of the Government armament program. This will involve bullet cores, shell casings, gages, machinery and other factors with which the wire industry was concerned in the last war. It is interesting to note that, due to the doubtful future availability of sufficient copper for an emergency, some of the larger calibre shells, like .50 cases, will be made of steel instead of brass.

While we live in an atmosphere of uncertainty at the moment, let us not forget that this is still America—the land of the free, of opportunity, of initiative and of good living. Malevolent forces are constantly working to change all this and it is up to every citizen, including the rank and file of labor, to be alert to the machinations of private and political ambitions that would sell us all "down the river."

Under the present set-up there are two things the country would profit from right now—a strengthened labor law that would require greater labor responsibility and the removal of organized labor from exemption to restraint of trade provisions that business is required to observe.

Better yet would be a realization by both labor and management that they are in fact partners in business. Should such an awareness ever materialize there will be no further need for Federal labor boards or laws governing employer-employee relationship.

—from the Editor's Desk

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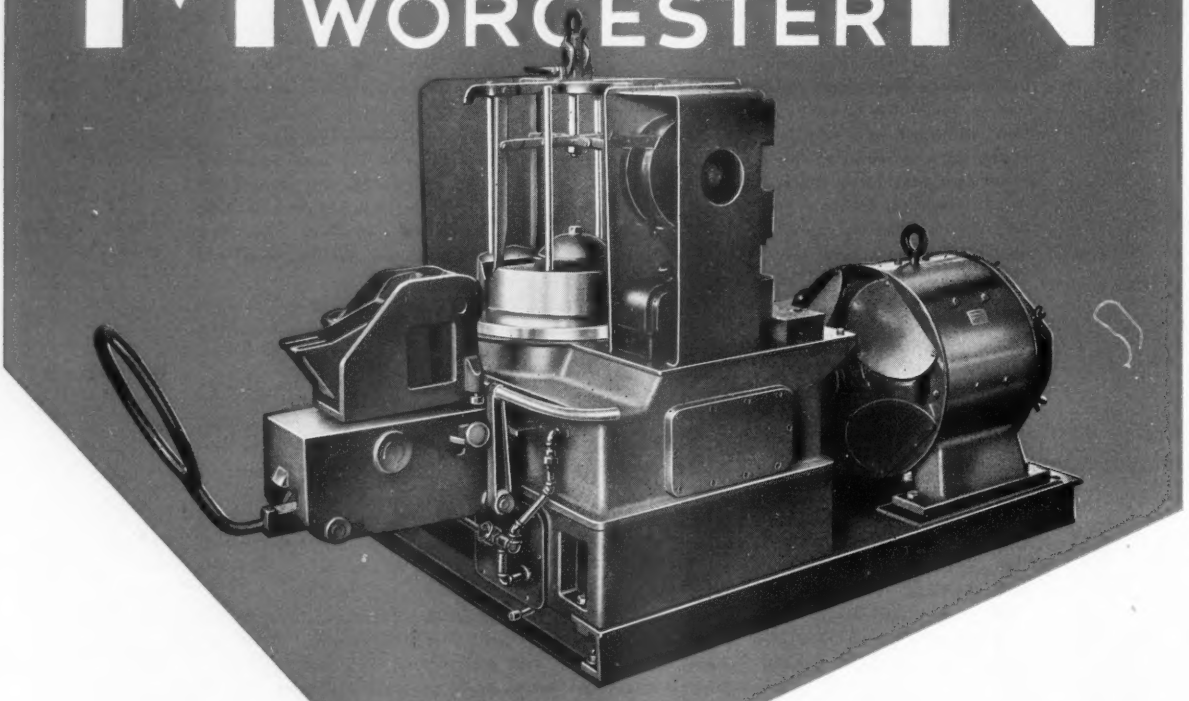

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Vol. 24 NOVEMBER, 1949 No. 11

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— ASSOCIATE EDITORS —

Kenneth B. Lewis, Consulting Wire Mill Engineer
Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
R. S. Spengel, Business Manager
E. D. Sickels, Advertising Manager

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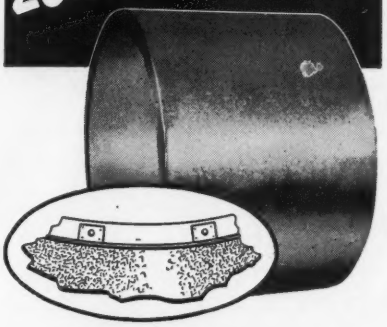

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 24 NOVEMBER, 1949 No. 11

A Rapid, Simple Method of Determining Shape of Wire Dies

By Eugene M. Smith,
Battelle Memorial Institute
Columbus, Ohio.

This paper provides some practical suggestions for die manufacturers and die-room foremen, growing out of one of the Battelle Institute's projects in wire manufacture research.

A SIMPLIFIED method for measuring the diameter and shape of wire-drawing dies has proven superior to methods commonly used. During both manufacturing and repairing, it should be advantageous to have a means for measuring the die shape quickly, easily, and accurately.

★ ★ ★

DIES are generally identified by stamping the gage and blank size on the die blank. Sometimes the entrance angle or half-entrance angle may also be stamped on the blank. However, when the die has a well-radiused bell, the entrance angle is a variable, depending upon the diameter of the wire to be drawn. Bearing length of dies, although not generally recorded on the blanks, are always specified. The length of the bearing, still somewhat a matter of controversy, appears to be determined on the basis of compromising the best judgment of the purchaser and seller. It is recognized that too short a bearing length results in short die life, and high replacement costs. Too long a bearing increases friction and may cause necking down of the wire during passage through the die.

★ ★ ★

CONSIDERABLE difficulty in determining the effect of slight variables in die design arises from the lack of accurate and reliable methods for determining the true shape of the die.

★ ★ ★

TECHNIQUES adapted for die measurement consist either of preparing a cast or impression of the die cavity, or mechanically measuring a trace of the contour of the die by use of a feeler gage. Of the former techniques, insertion of a soft, copper wire or wooden dowel is the most rapid method available. However, relaxation of the tapered pattern may occur and distort the impression. Further measurement of the model is tedious, if accuracy is desired. Similarly, casts of the die aperature can also readily be made by pouring plaster or low-melting metal (Wood's Metal) into the die. To make a sharp casting and extract it, without damage, can be difficult at times. The use of lubricants or other compounds to facilitate parting might be suggested. Uneven application of the lubricant distorting the casting is an ever-present possibility.

★ ★ ★

ONCE a suitable cast pattern of the die has been obtained, eccentricity and gage can be determined by a micrometer. Measurement of the taper is somewhat more difficult, but can be made with the aid of a goniometer.

★ ★ ★

THE second means available for determining die contour is best exemplified by description of an apparatus recently illustrated by **H. Mucke** (1). A feeler-gage type of instrument was proposed for measuring and recording contours of dies of medium size. Unsuccessful attempts to adapt opti-

cal methods lead to the perfection of the mechanical device. A needle-shaped feeler, attached to a pantograph-type linkage, is used to transmit the motion of the point to a recorder. Magnifications up to 100X can be obtained if a mirror galvanometer is incorporated in the instrument.

★ ★ ★

THE apparatus is recommended for use on die holes less than 5/64 inch in diameter. Obviously, for larger die openings, the device is not particularly necessary. For very small gage dies its use is precluded by the necessity of the feeler wire to be sufficiently large to provide rigidity.

★ ★ ★

A VARIATION in the technique of determining die shape is proposed that appears to have all the advantages of the methods previously described, and none of their deficiencies. Facsimile impressions of die contours can be obtained with the use of a hard, dental, inlay-casting wax. This type of wax is readily softened by holding over a small flame. The impression is quickly obtained by pressing the softened wax into the die cavity and holding momentarily until rehardening of the wax occurs. Plastacine or modeling clay may be used as a back-up to prevent the softened dental wax from being extruded beyond the bearing length and into the relief-angle cavity, making removal difficult. Visual examination of the profile of the wax impression can be made immediately upon removal. The sequence in making the wax impression is shown in Figure 1.

★ ★ ★

IF greater magnification is desired, or if the contour is to be recorded, several means can be used. A photographic microscope or a shadowgraph have both been used to provide sharp images of the pattern profile at 100X. Figure 2, is typical of a photomicrograph obtainable at 15X. Greater magnification could be used, if necessary, but generally it serves no useful purpose.

★ ★ ★

WITH the dental-wax impression method of determining die contour, it is possible to prepare rapidly and at small cost, a series of replicas of variations in die contours, and thus provide a permanent record of the effect of die contour on drawing.

★ ★ ★

Reference

(1) Mucke, H., Stahl u Eisen, Vol. 60, No. 25-26. 1948, P. 484. Also obtainable in Henry Brutcher Translation #2251, Altadena, California.

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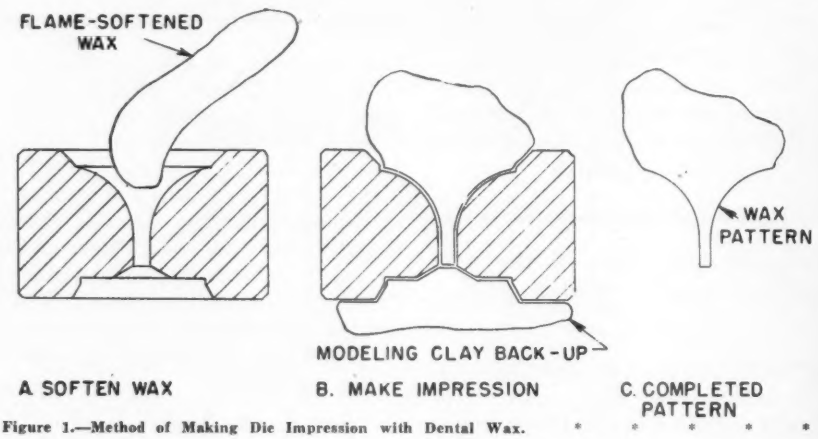

Figure 1.—Method of Making Die Impression with Dental Wax.

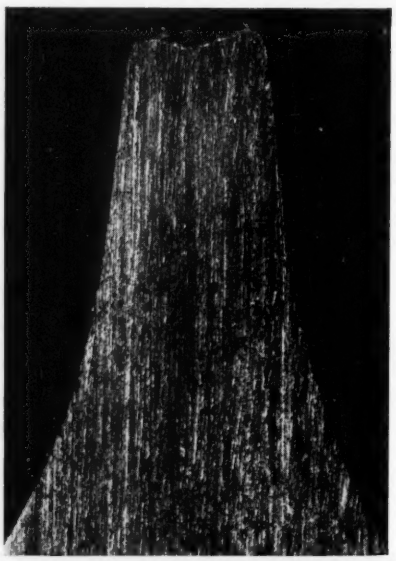

Figure 2.—Photograph of Wax Impression.

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Tin Coatings In The Wire Industry

By Frederick A. Lowenheim and Herbert E. Hirschland,
Metal & Thermit Corporation,
New York, N. Y.

Paper presented before the Wire Association Convention October 17-21, 1949, La Salle Hotel, Chicago, Illinois.

THE consideration of the application of tin coatings to wire and wire products may be conveniently subdivided in two ways: (1) the nature of the wire so coated and (2) the methods used in forming the coating. This paper is principally concerned with a discussion of the second category, and only a few words of introduction need be spared to the first.

★ ★ ★

THE two types of wire to be considered are steel and copper. Although the amount of steel wire which is coated with tin represents only a small fraction of total production, such wire does have important uses, particularly in woven and fabricated wire products and for specialty applications. Tin is the metal of choice for situations involving contact with foods and beverages. The tinning of copper wire, on the other hand, is extensively practiced, because of the property possessed by copper of deteriorating the rubber insulation. When a coating of tin is interposed between the copper and the rubber, this deterioration is halted or very much slowed down.

★ ★ ★

THE standard procedure for applying tin coatings to wire has been the hot-dip method — that is if we exclude for the moment very light coatings such as are applied by aqueous immersion processes, which will be considered further on. The hot-dip method consists essentially in merely passing the wire through a bath of molten tin, with the aid of appropriate fluxes and protective materials, and wiping off the excess tin. Thus hot-dipping possesses the advantage of simplicity in operation, which it must be said is in many cases more apparent than real.

★ ★ ★

DISADVANTAGES of the hot-dip method may be classed as (1) operating and (2) economic. The operating difficulty is that in spite of the best efforts of engineers over many years, the process does not give a uniform product, and various defects—black specks, discontinuities in the coating, etc. continue to occur. Economically, the process is wasteful of tin because coatings are heavier than necessary, at least in most cases, and drossing of the tin in the pot causes additional losses of this rather expensive and—during war time—strategic metal.

★ ★ ★

THERE are many methods of applying a coating of tin to base materials, but only three need be considered here as possible alternatives to hot dipping. These three are: aqueous immersion, electroplating, and immersion in fused salts. The first two are relatively well known, the third is at present in a preliminary developmental stage.

★ ★ ★

Tinning by Immersion in Aqueous Solutions

THE art of tinning small articles by soaking them in aqueous solutions of tin salts has been practiced for many decades. Many of the formulas used require boiling temperatures and times of immersion on the order of several hours. Such procedures, of course, would have no place in wire manufacture. Nevertheless aqueous immersion tinning does have an application in the wire industry, with which you are all familiar: the so-called "liquor finish" process.

★ ★ ★

THIS process is extensively used on steel wire both to provide superior drawing qualities and to improve the appearance of the finished wire. The coating applied is not tin but a tin-copper alloy, and by varying the composition of the solution the alloy deposited may be varied from pure copper to coatings high enough in tin to give a white color. The deposit forms by simple immersion, no outside source of current being required.

★ ★ ★

THE solutions used contain copper sulfate, stannous sulfate and free sulfuric acid. It was formerly the practice to make up a solution of copper sulfate + sulfuric acid and to provide the tin content by reacting this solution with feather tin. However, with the availability of stannous sulfate as a commercial chemical it has been found more advantageous to add it as such and dispense with the feather tin. The advantage thus gained—ease of control and maintenance of the solution—more than outweighs the additional cost of the tin in chemical form; and the introduction of this method has led to increased die life, probably because of the absence of small particles of tin dropping off the feathered material.

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IN a modification of the liquor finish process, the wire is first coated with copper or copper-tin alloy in the usual way and then given a so-called "white liquor," finish in a second solution consisting of stannous sulfate or chloride + free acid, used boiling.

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THE tin or tin-alloy coatings applied to steel wire by the liquor finish process are useful in enhancing the appearance of the wire and for improving its drawing qualities, but possess little corrosion resistance. The process cannot be considered a substitute for hot-dip tinning.

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PROCESSES are available for applying an immersion coating of tin on copper as a base metal, and these are widely used in the tinning of small parts for electrical work, for coating the inside of copper and brass tubing, and the like. They do not appear to have been applied to copper wire as such (pins excepted) nor is it known whether such processes would be adapted to this use. Many solution formulations are available: a typical one is based on sodium cyanide, sodium hydroxide and stannous chloride, (1). This method yields adherent and relatively bright coatings of tin, but the thickness of coating is severely limited.

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Electroplating

ALTHOUGH the problems involved are obviously not identical, there are many analogies between coating of wire in continuous coils and the coating of sheet metal in a continuous strip. Thus the undoubted success of the steel industry's strip electrotinning program for the manufacture of electrolytic tin plate naturally suggests the adaptation of the process to wire coating. It may be well to point out and correct a general misconception regarding electrolytic tinplate. This material is not an inferior war-time substitute for hot-dip. Experiments on the continuous electrotinning of steel strip had been initiated long before World War II seemed probable, and the process would have been developed even if tin had not become a strategic material. The War merely pushed the clock ahead by several years. Electrolytic tin plate has now taken its place alongside the hot-dip product as an accepted article of commerce.

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THE advantages which electroplating possesses over the hot-dip method may be summed up in the one word **control.** By proper control of the variables involved, the amount of tin applied to the base metal can be exactly predetermined and this value can be maintained indefinitely. Coatings much lighter or **much heavier** than hot-dipped can be easily obtained, subject only to one limitation to be mentioned later.

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DISADVANTAGES inherent in the electrolytic process must also be taken into account. These reside in two factors, equipment cost and appearance of deposit. In contrast to the relative simplicity of the hot-dip apparatus, continuous strip or wire electroplating requires electrical equipment, contacts, rinse tanks, and drying apparatus, as well as chemical analysis and control of plating solutions.

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FURTHERMORE, the deposit of tin as it comes from the plating bath is not the shiny and bright one familiar as a typical hot dipped coating. Regardless of which plating bath is used, the tin deposit has a matte, satiny appearance which, while quite pleasing, would not be satisfactory to the trade without some "consumer education". This condition can be rectified by the "reflowing" of the deposit, which consists in bringing the coating to a temperature above the melting point of tin and quickly quenching it. This reflowing or melting step is universally used in the manufacture of electrolytic tinplate. In addition to improving the appearance of the deposit the reflowing also somewhat improves its corrosion resistance, presumably by closing up pores. In the case of wire a redrawing step would have a brightening effect similar to reflowing.

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THE necessity—fancied or real—of remelting the tin coating does introduce a limitation into the otherwise almost limitless range of coating thicknesses possible with electroplating, for too thin a coating won't reflow and, if the deposit is too heavy, some tin will run off or gather into beads when it is remelted. However, this limitation is not in general very serious, since a very wide range of coating thicknesses can still be reflowed successfully.

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EXPERIENCE with reflowing of electrolytic tinplate has shown that any one of several methods is suitable for accomplishing this step. Basically the problem is merely to put heat into a moving strip of metal at a controlled rate, and it has been solved in several ways:

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INDUCTION heating has recommended itself to several manufacturers because it is very well adapted to automatic control and further because no actual contact with the moving strip is necessary; it also lends itself well to very high speeds of operation. On the other hand the installation is probably the most costly of all the methods.

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IN heating by conduction a suitable current is passed through the strip, heating it to the necessary temperature. This method is also well adapted to automatic control but does involve contact with the strip. Some problems of stray currents arise, but these appear to have been solved by the mills using this method.

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CONVECTION heating: the strip is passed through a furnace heated by gas, or through a space heated by radiant gas burners. Although possibly not so well adapted to high speeds of strip

travel and to automatic control, these methods have the advantage of economy and are being successfully used.

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REFLOWING in hot oil or fat is the standard method of processing small parts which require a fused coating. Though no longer used for electrolytic tin plate—because not well adapted for high speeds—it is simple and economical.

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THE problems involved in fusing the tin coating on wire should be analogous to but not identical with those encountered in strip; to a great extent the process should be less critical with wire because of the much reduced tendency of the tin to de-wet and gather into beads. It may therefore be concluded that the problem of reflowing the tin coating need not be considered a serious deterrent to the electroplating process.

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IT remains to consider some of the processes available for electroplating tin on wire. In this discussion it will not be necessary to differentiate between copper wire and steel wire, because the same electroplating solutions are adapted to both. Of course, the engineering problems will differ somewhat because of the difference in electrical conductivity and the tensile strengths of the two materials, but these details are beyond the scope of the present review.

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THERE are several tin plating solutions which have to a greater or lesser extent proven themselves practical in actual production, and of course many more which are so far unknown quantities in the patent literature. We confine our attention to those actually in use. It should be stated at the outset that no practical plating solution has been developed which gives a bright coating; all the deposits, from any of the solutions mentioned below, require reflowing if a hot-dip type appearance is desired. (Bright tin deposits have been obtained, but the processes have either proven impractical in actual production or have not yet passed the laboratory stage.)

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TIN plating solutions presently in use, then, may be divided into two categories, acid and alkaline. In detail, they are:

Acid Solutions

1. **Stannous Sulfate Bath.**
2. **Stannous Fluoborate Bath.**
3. **The Cresol Sulfonate Bath.**
4. **The "Halogen" Bath.**

Alkaline Solutions

5. **Stannous Chloride—Caustic Potash Bath.**
6. **The Sodium Stannate Bath.**
7. **The Potassium Stannate Bath.**

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BATHS 1 and 2 are in fairly general use for a variety of work; 3 and 4 are at present confined entirely, or almost so, to electrolytic tinplate production. Bath 5 is practically obsolete in this country, though still used to some extent abroad, and will not be further considered. Bath 6 is in very wide use for general job shop plating, in automatic plating machines, still tanks, and barrels, and also for electrolytic tinplate. Bath 7 is a recent improvement over 6 and is replacing it in some applications; it is also in use for electrotinning of strip.

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SOME general remarks can be made in comparing the acid baths, on the one hand, with the alkaline (excluding No. 5) on the other (2); and it will be seen that both types have advantages and disadvantages. In favor of the acid solutions are these factors.

1. Ampere-hours per pound of tin plated are just half that required from alkaline stannate solutions. This is because the tin in an acid solution has to be reduced only two valences $Sn^{++} \rightarrow Sn$) vs. four in the alkaline ($Sn^{++++} \rightarrow Sn$). Operating voltages are also somewhat lower than those required for stannate baths. The combination of these two factors results in lower power costs for the acid solutions.

2. For some (not all) of the acid solutions the permissible cathode current densities are somewhat higher than for the alkaline. This seems to be particularly true of the "Halogen" process. Faster plating is therefore at least theoretically possible with this bath than with the others.

3. Anode control is not such a critical factor as with the stannate baths.

4. The baths operate at or near room temperature, so do not require to be heated.

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CORRESPONDING disadvantages of the acid solutions may be listed as:

1. No simple acid solution yet developed will give an acceptable tin deposit. All these baths require addition agents of organic or colloidal nature in order to yield results. Such agents are not susceptible to ordinary chemical analytical control and must be controlled by special methods; many are protected by patents and must be purchased under fanciful names and controlled by rules of thumb. Some solutions require several such agents.

2. All acid solutions require rubber-lined apparatus and those containing fluorides tend to be severely corrosive to general plant equipment.

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CONSIDERING now the particular advantages of the alkaline stannate baths, we may mention:

1. Simplicity of formulation and control. The baths have only two essential ingredients: the alkali stannate and the corresponding alkali hydroxide; and only two factors to be controlled, the free alkali and the tin content, both readily determined chemically. In addition, while it is of course desirable to control these variables fairly closely, it is nevertheless noteworthy that the analysis of the bath can be allowed to vary within wide limits without destroying its operability.

2. The alkalinity of the solutions and the fact that they operate at elevated temperatures connote that plain steel equipment can be used without danger of corrosive fumes (except steam), and that the solutions have some cleaning properties which render somewhat less critical the preplating cleaning procedures. It is not however meant to imply that the cleaning can or should be eliminated; only that an occasional spot of grease will have less drastic effects when the plating bath has this detergent property.

3. The throwing power (ability to plate into recesses, etc.) of the alkaline stannate baths is much better than that of the acid baths. This particular advantage is however probably of minor importance in strip and wire plating.

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FINALLY, it may be pointed out that the higher current consumption of the alkaline baths is not a serious fault in most cases, for plating power is usually a very minor item in the overall cost of any plating job.

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ENOUGH has been said to show that no one plating solution

possesses a monopoly of all desirable features, and in choosing a bath for any particular job a great many factors must be taken into account. Thus for job plating the alkaline stannate baths are the almost universal choice; in routine automatic plating set-ups where the type of work is quite constant, the sulfate and fluoborate solutions share the field with stannate baths; while in electrolytic tinplate production the field is squarely split, about half the producers choosing alkaline and the other half acid electrolytes: of the latter, again, the "Halogen" and the cresol sulfonate each have their proponents, and of the alkaline type both sodium and potassium stannate are in use.

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ELECTROTINNING of wire at high speeds of operation is, so far as is known to the present author, still in the experimental stage; but the experience gained in strip electrotinning should be of value in hastening this development. With no thought of disparaging the undoubted merits of the acid electrolytes, our further discussion will be confined to the alkaline stannate baths.

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FOR many years the standard electrolyte for tin plating has been the sodium stannate bath, (3). After its introduction, early in the 30's, it quickly displaced older types of solution until it was in almost universal use. Its one serious limitation is the lack of good current efficiency at high current densities, which limited the possible speed of plating. Naturally, the amount of tin applied to a given area in a given time depends on the current applied to that area—the current density — and the current efficiency at that current density. And it is unfortunately true that as the current density is raised much above about 40 amperes per square foot, the current efficiency falls at approximately the same rate so that the net effect is no increase in speed of deposition.

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THIS drawback became serious only when the modern trend in electroplating began to demand greater and greater speeds, particularly for just such applications as continuous strip-and wire-plating. This defect in the otherwise excellent sodium stannate bath probably provided the impetus behind such developments as the high-speed "Halogen" solution. It led the present author to investigate the possibilities of using potassium stannate in place of sodium stannate, with the result that a new alkaline solution was developed which retains all the desirable features of the sodium stannate bath but substantially removes the limitation on plating speed, (4).

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ON this basis the potassium stannate bath was introduced and is beginning to meet with trade acceptance in a variety of work, from job shops to large automatic platers and, as already stated, in electrolytic tin plate. Advantages resulting from the substitution of potassium for sodium in the alkaline stannate bath include:

1. The cathode efficiency remains at usably high levels at much higher current densities, when the bath is properly formulated and controlled. While the upper practical current density for sodium stannate is about 40 ASF, the potassium bath may be operated as high as 250-300 ASF or even higher. The practical upper limit has not yet been determined in actual production, though laboratory experiments have been successful at 1000 ASF. These extremely high speeds of operation require more concentrated baths than are used with sodium stannate, and these higher concentrations are made possible by the fact that:

2. The solubility of potassium stannate, both in water and in alkali solutions, is much greater than that of sodium stannate. Further, the solubility increases as the temperature is raised in contrast to the sodium salt which is one of that unusual class of chemicals which has a "negative" temperature coefficient of solubility. This higher solubility of the potassium salt makes possible the employment of more concentrated solutions at elevated temperatures, without the hazard of precipitating stannates during operation.

3. Potassium stannate solutions are more stable than those of sodium stannate. All tin salts tend to hydrolyze with the precipitation of insoluble sludges, but this tendency is much less with the potassium salt. These sludges represent an economic loss of tin, besides fouling the solution and possibly leading to rough deposits.

4. All potassium salts have higher conductivity than the corresponding sodium salts. This high electrical conductivity makes possible the use of somewhat lower voltages for a given current density.

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WITH the exception of the foregoing factors, the operational characteristics and quality of deposit obtained in the two alkaline stannate baths are quite comparable. Thus the potassium stannate solution offers all of the favorable features which have rendered the sodium bath deservedly popular for all types of work. In addition, the new bath offers speeds of deposition equalling or approaching those possible with the newer high speed acid baths.

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IT is now necessary to refer briefly to a problem in the operation of stannate baths which we have up to this point neglected in our discussion: namely, anode control. Naturally, for the continued successful operation of any plating bath, the anode reaction must be the exact reverse of that at the cathode, in order that the metal content and pH of the bath will remain constant. (In chromium plating this is not true but this is rather a special case which need not be discussed here.) Unfortunately, tin anodes in a stannate bath fulfill this necessary condition only when rather carefully controlled. Depending on factors which will be discussed in a moment, tin anodes may

1. **Dissolve as stannate, at current efficiences ranging from about 60-95%.**
2. **Dissolve as stannite (bivalent tin).**
3. **Become passive and not dissolve at all; instead oxygen is evolved at 100% efficiency.**

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IN order to arrive at (1) it is necessary to operate the anodes under such conditions that they have a typical greenish yellow film. This requires (a) that the film be formed by impressing momentarily upon the anodes a surge of current higher than the normal operating current and (b) that after

forming the film as above, the proper current density, temperature and alkali content be maintained. The current density range for proper anode operation is relatively narrow.

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IF the film has not been formed, or if improper operating conditions are allowed to develop, the anodes may dissolve wholly or partially as stannite (2); the presence of this constituent causes spongy, dark and non-adherent deposits. On the other hand, if anode current density becomes too high, they may become passive and fail to dissolve. Under such conditions satisfactory plating can be indeed maintained for a while but the tin content of the bath will be depleted and must be replenished chemically.

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A PARTIAL solution to this anode problem has recently been announced in the development of the Alloy High Speed Anode, (5). This anode, which is about 99% tin, 1% aluminum, has much more favorable characteristics than pure tin; it is usable at higher current densities and does not require the initial current surge to film. The anode performance is thus brought more nearly into line with the favorable cathode performance of the potassium bath. The aluminum, of course, does not plate out at the cathode but accumulates in the solution as a harmless inert ingredient.

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TO summarize what has been said about the electroplating of wire, these points may be emphasized.

1. **Electroplating is admittedly a somewhat more complicated process than hot dipping, requiring more expensive apparatus and more technical control.**
2. **However, the possibilities of electroplating appear to offer sufficient advantages to offset this drawback. The quantity of tin applied can be controlled at the optimum, from the standpoint of performance, economy or both, and the resulting product will be uniform and substantially free of defects.**
3. **It has been pointed out that electroplating has been applied to the production of tinplate with outstanding success, and the analogies between continuous strip and wire suggest that development of continuous wire plating at high speeds should be equally successful. (It is not meant to imply that plating of wires is completely untried, of course; but its adaptation to tin is believed to be as yet in the development stage.)**
4. **Several possible plating solutions have been mentioned, and the potassium stannate bath chosen for more extended discussion because this bath appears to offer the best compromise between the high speeds of operation possible with some of the acid solutions and the favorable operating characteristics of the alkaline type of bath.**

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BEFORE leaving the subject of electroplating, a further possible advantage of adopting this method of tinning should be mentioned, although it is as yet in the exploratory state. This has to do with fabricated wire products, such as for example, braided wire and wire screening, and the attractive possibility of applying the tin coating after rather than before fabrication. With braided wire, for example, the tinning of many individual strands of fine, easily broken wire could be replaced by the plating of only one length of strong braid. Hot dipping obviously is unsuited for such an application because the flexibility of the braid is completely lost; but early trials of electroplating appear promising.

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Tinning in Fused Salts

A POTENTIALLY very useful method of applying tin to wire and fabricated wire products has already been alluded to before this Society by Dr. Gonser, (6). Three years ago in discussing Tin Coatings at the New York Convention Gonser referred to the work done for the Tin Research Institute on the coating of steel and copper by immersion in molten salt baths containing anhydrous stannous chloride. Shortly thereafter Hoge, (7), reported a brief study of a similar process and a German publication has emanated from the Deutschen Kupfer Institut (8). The last-named paper implies that the process was in actual commercial production. In this country, so far as is known, the development stage has not yet been passed. However, because the process appears to have considerable interest if the technical and economic problems are successfully solved, a few words of discussion appear justified.

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WHEN a piece of steel or copper is immersed in molten stannous chloride, the following reaction takes place.

$$M + SnCl_2 \rightarrow MCl_2 + Sn$$

where M represents Fe or Cu (M may be other metals as well; but with zinc or aluminum, for example, the reaction is too violent to be useful). The tin thus set free deposits on the surface of the metal.

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AT first glance this reaction is very similar to the familiar aqueous immersion process, when copper, for example, is deposited on steel.

$$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$$

But in fact the analogy is only formal and the two processes are quite different. Since the molten salt reaction takes place at temperatures above the melting point of tin the coating is bright, similar to hot-dipped coatings; for the same reason—the elevated temperature—the tin and the base metal readily interdiffuse and the coating is therefore not limited in thickness as is an aqueous immersion deposit, but continues to grow with time. As a corollary to this, of course, it will be seen that the deposit is not pure tin but a graded series of alloys of tin with the base metal.

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TEMPERATURES employed for this process are in the range 660-850°F. Although pure stannous chloride can be used as the salt bath it is preferred to dilute it with an inert salt such as potassium chloride. Times of immersion vary from a few seconds up to several minutes. By control of the three variables composition, temperature, and time, the nature and the thickness of the coating can be determined.

(*Please turn to page* 1068)

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Continuous Strand Cleaning and Coating of High Carbon Rods and Wire

By David L. Doty

Metallurgical Department, Aliquippa Works,
Jones and Laughlin Steel Corporation,
Aliquippa, Pa.

Paper presented before the Wire Association Convention, October 17-21, 1949, La Salle Hotel, Chicago, Illinois.

Introduction

THE importance of complete and uniform removal of scale without over-pickling, and subsequent uniform coating of rods and wire prior to cold drawing is well recognized by the steel wire producer. While many other factors enter into the production of quality wire, the cleaning and coating operations stand out as critical points.

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INVESTIGATORS, in pursuing the development of what are believed to be new processes or products often discover that something of the same nature has been tried before, or is being used, at least in a modified form, in an allied product or industry. As the Biblical prophet so wisely stated centuries ago, "There is nothing new under the sun"; so, the matter of continuous strand cleaning and coating is not new. For years wire mills have been carrying out this process in the wire galvanizing operation. The continuous cold reduction of strip steel for tin plate, auto body sheets, etc., is preceded by a continuous pickler which removes scale from the strand of strip and, in tandem, coats the cleaned strip surface with a film of oil to prevent oxidation and to aid in lubrication for cold reduction. Also, during the recent war, at least one wire plant was producing .013" redrawn galvanized, high tensile wire for the U. S. Signal Corps by patenting, cleaning and galvanizing the breakdown stock in a tandem operation.

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TO date the common practice for scale removal and coating in the wire industry has been the batch method. While it is possible that continuous strand cleaning and coating may some day replace this method entirely, thus far this development has been confined mainly to finding ways and means of inserting the process in tandem with the strand patent annealing operation employed on high carbon rods and wire. It is this phase of the process which will be discussed in this paper.

DAVID L. DOTY

Mr. Doty is a Metallurgical Supervisor of the Jones and Laughlin Steel Corporation, Aliquippa Works. After graduating from Pennsylvania State College in 1939 with a B.S. Degree in metallurgical engineering, he entered the employ of the above Corporation in the Metallurgical Department. In 1940 he was made Assistant Chief Metallurgical Inspector of the Rod and Wire Departments and in 1945 was promoted to Chief Metallurgical Inspector of the same divisions. In 1948 he was elevated to the position which he now holds. * * * *

Advantages of Continuous Process

IT is not the intent of this discussion to cast any ill-deserved criticism or unfavorable light on the batch method of cleaning and coating, since considerable progress has been made over the years in practices, methods and equipment, and generally a wire of good quality can be produced. However, it is believed that cleaning and coating in strand form, continuously, has definite possibilities for improvement over the batch method in finished wire quality and reduction of operating costs.

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FROM a quality standpoint, the batch method possesses an inherent disadvantage in that the cleaning and coating media do not have equally free access to all convolutions of the rod and wire coils. There is present, then, the tendency toward under-cleaning or incomplete scale removal of the closely laid strands which are deep seated in the coil. Additional time in the acid solution can be allowed in an attempt to effect complete scale removal of these inner strands, but in so doing there is an equally dangerous tendency toward over-pickling the outer coil convolutions which are more freely exposed to the pickling medium. By virtue of the same conditions there is the tendency for non-uniform coverage throughout a coil with respect to the coating medium.

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ANOTHER disadvantage which works against quality is the possibility of the occurrence of rust after batch cleaning and coating of fine wires. This has been attributed to entrapped moisture which remains in the closely packed coil strands and often persists even though it has been thought that an adequate drying or baking job has been carried out.

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IT is not meant to imply that every yoke of batch cleaned and coated rods or wire will always exhibit the extreme in non-uniformity. However, since the method itself possesses tendencies which work toward a non-uniform end result, there is the possibility to have gradations of non-uniformity which can be readily reflected in finished wire quality. However, it is believed that there are definite potentialities in the continuous strand process whereby these quality disadvantages can be substantially minimized if not entirely overcome. In this process each convolution of the rod and wire coil would have equal access to the cleaning, coating and baking media, so that there is greater probability of obtaining uniform scale removal, uniform coating coverage and drying throughout a coil and from coil to coil.

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WITH regard to operating costs, the continuous strand cleaning and coating process, after full development has been realized, should show a definite savings. This would accrue largely from a savings in manpower, since the process would be inserted in tandem with the already established patenting operation. The manpower required for the handling of coils between the patenting take-up blocks and the cleaning house would be eliminated, as well as the manpower in the cleaning house employed to transfer coils from the acid tubs, rinsing and coating tanks. Also, it is conceivable that only a bare minimum of help would be required to attend to the control of the cleaning and coating media, and in some cases, it may be possible to utilize the existing labor now assigned to the patenting units for such work. In addition, since it is believed that greater uniformity in cleaning and coating will result from the strand process, it is very likely that this advantage will be reflected in higher wire drawing speeds and longer die life.

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Status of the Continuous Process

THIS paper will deal with the continuous removal of scale in strand form by

(1) Mechanical means,
(2) Chemical means,

and the problems connected with the subsequent strand coating treatment.

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IT should be made clear that the ideas and information contained in this paper are not entirely the experiences of the Jones and Laughlin Steel Corporation but, rather, an attempt at a summation of the available information on the subject obtained from other wire producers in the industry. Further, it must be understood that the process to date is for the most part in the experimental stages. While there may be a few lines in operation production-wise at the present time, there are still many problems to be worked out. Therefore, at the present time there is very little in the way of concrete data which can be presented, since a constant changing of ideas has been continually taking place. However, it is hoped that the information presented herein will stimulate both discussion and thinking on the problem.

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TO date, there have been two major obstacles in the development of the strand cleaning and coating process in conjunction with the patent annealing operation. The first is lack of linear distance and the second is that involving coatings.

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IT is axiomatic that the coupling of several operations in tandem with each other, particularly where one or more of the operations has formerly been batch type, requires straight line footage. This element comes at a high premium in most plants. In most cases, experimentation has been carried out on existing patenting units whose original designers permitted only sufficient space between the furnace exit and the take-up blocks for the strands to become sufficiently cooled, so that they could be readily removed by the blockers. The amount of space available varies within any given plant and from plant to plant depending on the type of patenting quench employed. Space, therefore, has set the pattern for many of the investigations and has been responsible for the wide variety of mechanical set-ups and treatments in an attempt to accomplish the desired end result. Those plants where straight line space is available have had their problems simplified, while others who are not so fortunate have been forced to improvise by, for instance, backtracking through solutions or by taking advantage of vertical space. For the most part, work connected with continuous strand cleaning and coating has been carried out in conjunction with the double-lead and electric resistance patenting operations due to the smaller sizes processed on these units and to the lighter scale as compared with flame patenting. The problems attending the application of an adequate coating will be discussed later in the paper.

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Mechanical Scale Removal
Shot Blasting

THE first mechanical scale removing process to be discussed is that of shot blasting. While this process is in the development stages for descaling rods and wire, it has been used effectively for some time in materially increasing the fatigue life of steel parts, such as rocker arms, leaf springs, connecting rods, coil springs, gears, etc., which are subject to bending or twisting stresses. However, with respect to continuous descaling, one major producer of steel strip is reported to be currently using shot blasting successfully on

a production basis in combination with acid pickling. A specially designed machine removes approximately 70 to 80 percent of the scale by this blasting method, the remaining scale being removed by a comparatively short immersion in an acid tank. This producer has been able to turn out a cleaned hot band of good quality using this method, and, in addition, has profited materially by being able to increase the pickle line speed from 300 feet per minute, formerly attained on straight acid pickling, to 500 feet per minute. This advantage has eliminated a production bottle-neck which it had originally been considered to overcome by the installation of an additional pickle line at a considerable investment cost.

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SHOT blasting can be carried out by either the airless or air blasting methods. The latter method, employing compressed air as a propelling force for the shot, has been used mainly for special applications involving intricate shapes. The airless method, more recently developed, appears to be more applicable to the problem under discussion, due to the fact that the velocity of the shot in the blast can be more readily controlled and a high rate of shot flow can be readily maintained.

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THE airless blasting method consists essentially of feeding shot of a predetermined size from an overhead storage hopper to the center of a bladed wheel, or wheels, of predetermined diameter and width. The wheel under rotation at high speed employs a combination of radial and tangential forces which propels the shot at the work and thus imparts the necessary striking velocity to the shot. The impingement of the shot, reported to travel at a velocity of approximately 12,000 to 14,000 feet per second, exerts both an abrasive and shattering action on the scale, thus freeing it from the steel base.

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CONSIDERABLE improvement has been made in the type of shot used in the airless blast method. Until recently, chilled iron and heat-treated cast iron were used in manufacturing the shot. These materials have been found wanting in withstanding the impact in peening and cleaning operations, and as a result, the cost of replacing the disintegrated or broken shot have been higher than desired. Recent developments, however, employing a shot prepared from special heat-treated, high carbon steel, have definitely shown promise toward materially increasing shot life.

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ABOUT eight years ago the Wire Department of **Jones & Laughlin** submitted trial coils of patented rope wire and spring wire in sizes .109″ to .225″ to a manufacturer of shot blasting equipment for experimental cleaning. The cleaning medium used, however, in this case was a mixture of grit and shot. It was observed that an adequate job of scale removal had been accomplished and physical properties on the resultant drawn wire were generally equal to companion lots of batch acid cleaned product. Mechanical cleaning speeds were equivalent to those employed in the patenting operation. It was noted, however, in testing the finished wire that reverse bend values in some instances were somewhat lower than those observed on the acid cleaned product. Examination of these samples indicated the presence of angular pit remnants on the finished wire, the source of which was believed to have originated from angular impressions on the patented stock caused by the grit employed in cleaning.

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WHILE subsequent tests were not conducted using 100% shot, present methods would employ complete shot make-up in the blasting apparatus. The character of the surface impressions made by the impingement of 100% shot on the wire or rods has been studied by the manufacturers of shot blasting equipment and it has been found that the shot blasted surface exhibits a pattern of rather shallow, dimpled impressions, the bases of which are rounded and not angular. Also, limited investigation made by some equipment manufacturers has disclosed that these impressions are readily erased in subsequent cold drawing with no angular remnants remaining on the finished wire which would act as focal points for premature failure in fatigue or bending.

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AGAIN, it should be emphasized that this process is in the developmental stages regarding continuous strand cleaning of rods and wire and time will be required to fully ascertain the value of its application. However, that wire people are seriously considering this method is evidenced by the fact that an equipment manufacturer has designed a shot blasting unit for a wire producer to be placed in tandem with a 40-strand patenting furnace. This is presumably a flame-fired furnace which patents up to $\frac{5}{8}$″ rods. The cabinet through which the strands will be led for cleaning amounts to 22 feet in overall length. Along with the necessary auxiliary equipment, the unit will employ a total of 8 airless shot propelling wheels, 4 wheels being placed above the strands and across the width of the travel of the rods and 4 placed below the strands in the same fashion.

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AFTER cleaning, it is planned to lead the rods, in strand form, into a lime bath for strand coating. Shot blasting will start at a point where the rods are about 800°F. in temperature. While the blasting cabinet has a cooling effect on the rods, due to the fact that air is drawn from outside through the cabinet vestibules, this heat loss is partially offset by the heat energy imparted to the stock by the impingement of the shot. It has been estimated that the rods will enter the lime bath at a temperature of about 300 to 350°F. which, it is claimed, will help to facilitate drying after coating. Additional claims have been made that the dimpled impressions on the cleaned

rod surface will aid materially in picking up sufficient lime coating for satisfactory cold drawing. It is conceivable that the distance required for the shot blasting and coating equipment would not exceed 50 or 60 feet and in instances where the space between the furnace exit and the take-up blocks is limited, this method of cleaning would become attractive.

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Rotary Brush Cleaning

ALTHOUGH much less known than shot blasting, another method for descaling rods and wire which should be given consideration is rotary brush cleaning. In rotary brush cleaning the descaling device is termed a "brush roll" composed of a multitude of high strength, special steel, fine wires which act as the "bristles." The brush, rotating at high speed, contacts the work and abrades or wears away the scale from the steel base. In cases where a tight scale is encountered, a liquid cutting compound is employed on the work or brushes, as desired, to increase the efficiency of the brushing action.

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TO date there are no known contemplated rotary brush installations for descaling rods and wire in tandem with the patenting operation, since investigations into its possible use have been under way for a very short time. The investigations have been carried out by a brush manufacturer on limited amounts of patented stock and under an improvised laboratory set-up. Results obtained to date, therefore, are merely indications of what might be accomplished and cannot be interpreted as definite trends.

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PRELIMINARY work conducted on a 7½ (.170″) gage patented wire, possessing a scale similar to that encountered in double-lead or electric resistance patenting, showed encouraging results with regard to scale removal. From the brush manufacturer's observations, it was estimated that a satisfactory job of descaling could be accomplished at speeds of 50 to 60 FPM of wire travel which is considerably above normal patenting speeds for this wire size. The brush-cleaned 7½ gage stock was drawn, after coating, to 16 gage wire at 1100 FPM and the finished wire exhibited a uniform finish with good physical properties.

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IN contrast to the dimpled impressions which were reported on the patented stock descaled by shot blasting, the finish obtained by brush cleaning was smooth and bright. In fact, it is possible to obtain a highly polished surface using rotary brushes. This surface condition will very likely work against adequate coating pick-up in the subsequent strand coating process and some changes or modifications in commonly used coating practices will have to be made to properly prepare the stock for drawing. However, consideration should be given to the fact that the polishing action of the brushes could very likely be employed to remove pits from the wire surface which accrue from prior processing, and thereby yield a finished wire of superior surface quality.

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THE present status of brush cleaning does not readily permit reliable estimates regarding the space required for a production unit. However, some preliminary thought has been given to this feature and it has been estimated that 10 to 15 feet of straight line distance would be required to install a brush cleaning unit for a 16-strand patenting frame processing sizes up to 7½ gage. Further experimental work will be required not only to establish this feature but to solve many other problems as well.

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Chemical Descaling

UP to the present time the most popular strand descaling means used in investigations and in lines already in operation has been acid solutions. The fact that cleaning has been carried out for decades with acid baths, the ready availability of acid, and the simplicity and low cost of installation have unquestionably influenced investigators to first explore this method for removing scale in strand form. Acid tub construction for the strand process has been for the most part, similar to that used in the cleaning operation connected with hot dipped galvanizing.

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AS previously stated in this paper, investigations into strand cleaning have been confined largely to the double-lead or electric resistance patenting processes, since the scale produced is much lighter than that encountered in flame patenting, thereby requiring less space to effect scale removal. Wire size is also another factor in the time required to descale and the majority of the investigational work has been conducted on sizes under .110″, although there are some few instances where sizes as large as .192″ are being cleaned continuously.

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THE optimum operating conditions for time of wire immersion in the acid, acid concentration, and temperature which have been recommended to date vary considerably from plant to plant. This is to be expected since individual patenting units vary with respect to the range of sizes which can be processed, the speed of wire travel already established to produce the desired microstructure, and the amount of scale formed. Therefore, the cleaning factors of immersion time, acid concentration and temperature must be brought into balance on each unit to conform with established patenting practices. In almost all cases muriatic acid is being employed for strand cleaning in concentrations of 12 to 20%. Temperatures of the bath vary between producers from 140 to 180°F. Considerable difference exists in wire immersion length in the acid tub, ranging from 5 to 20 feet. For example, one producer running .054″ Improved Plow patented wire at 50 FPM, immerses the wires for 5 feet of distance in 20% muriatic acid or a 6-second immersion; an-

other producer strand cleaning a similar size at the same speed and acid concentration employs a 20-foot acid immersion, equivalent to 24 seconds.

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RESULTS to date from various wire producers, investigating strand cleaning in tandem with double-lead or electric resistance patenting frames, have shown that an adequate, uniform job of scale removal can be accomplished in a relatively short time employing acid solutions. With regard to strand cleaning larger wires or rods which are flame patented, little work has been done to date. It is only logical to assume that the heavier scale will be more difficult to remove and will require more immersion time in the acid than that required for the double-lead or electric resistance patented products. It is believed, however, that the installation of adequate scale breakers prior to the acid immersion will aid materially in minimizing these problems.

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Strand Coating

WHILE it has been pointed out that an efficient strand descaling job can be accomplished using acid solutions, the problems attending the subsequent strand coating operation have not been easy ones to solve.

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THE main functions of the coating which is applied to rods and wire is that of acting as a lubricant carrier and buffer between the wire and die. It is highly important that the coating be distributed in a uniform fashion about the periphery of the wire or rod and throughout the coil, since the amount of coating present has a direct bearing on the amount of lubricant pick-up in cold drawing. Sections of a coil which have too little coating will carry a small amount of lubricant which can be readily reflected in greater than normal frictional heat in wire drawing, resulting in scratched wire and inferior physical properties.

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THE aim of strand coating in tandem with the patenting and strand cleaning operations, along with reduction in costs over batch coating, is to realize the ultimate in coating uniformity of the product prior to cold drawing. This aim, however, cannot be attained without first recognizing certain characteristics which the coating compound must possess:

(1) **It should possess properties which permit deposition on the rods and wire in sufficient quantity within a short time, so that adequate lubricant can be picked up in cold drawing.**

(2) **It should adhere firmly to the steel base and not flake or become detached when passing over sheaves or around take-up blocks.**

(3) **It should not be hygroscopic and should render adequate protection against rusting, in the event that the product should not be drawn immediately after coating.**

(4) **The coating compounds should be inexpensive.**

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WHILE there may be other characteristics required of a coating to perform its primary function, the aforementioned are some of the more important ones which are involved in the problem of applying a uniform coating in strand form.

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THE coating compounds which have been tried in strand coating or which are available for trial, are legion. These can be divided roughly into two groups. The first group includes those which cling to the steel base mainly by virtue of mechanical adherence such as lime, the alkalies (sodium orthosilicate for example), and the borates (sodium tetraborate). The second group includes those which react chemically with the steel base such as the phosphates. This latter group may be further broken down into the metal phosphates of iron, manganese or zinc, or combinations of these metals, and the hexametaphosphates which are not strictly deposited by chemical reactions but rather by polar attraction. These compounds are manufactured by various commercial chemical people under a variety of trade names. In many cases, manufacturers have combined two or more of these compounds or have added small percentages of other chemicals to one or more of these compounds which are reported to act as coating binders or coating accelerators. The majority of these coating compounds are applied at temperatures of 135 to 200°F. and in a wide range of concentrations, depending largely on the recommendations of the particular manufacturer. Those coatings which affix themselves to the steel base by mechanical attachment are generally used in concentrations considerably higher than those which are deposited by chemical reaction.

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LIME has been used as a coating in wire mills for decades and has, in general, performed well as a lubricant carrier. One of its most valuable assets is its comparatively low cost. However, the character of the lime coating is such that in the strand coating process it does not always remain intact on the wire when subjected to abrasion due to passing over sheaves or around take-up blocks. Lime is also hygroscopic and in the event the product is not drawn within a short space of time after strand coating, moisture is readily absorbed with resultant coating breakdown and rusting of the steel base.

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THE lime-substitutes are, generally, considerably more expensive than lime. However, there is a greater tendency for these coatings to resist abrasion and, in addition, the wire thus coated can be stocked for reasonable periods without deterioration of the coating or rusting of the steel base. This is particularly true of those compounds which react chemically.

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CONSIDERABLE variation in results has been realized among wire producers in experimenting with the various coating compounds in the strand coating process. While there may be some few exceptions, it is significant to note that to date the aforemen-

(*Please turn to page* 1065)

NEW, IMPROVED WIRE

For Manufacturing Recessed Head Screws

R. S. Simmons
Chief Metallurgist
Keystone Steel & Wire Co.

A new process has been developed by R. S. Simmons, chief metallurgist of Keystone Steel & Wire Company, that results in an improved wire stock for manufacturing recessed head screws. This unique process starts with the steel that is later drawn into the wire stock. The surface of the steel stock is improved to such an extent that it is comparable in characteristics to that found in the best of high grade bars.

Advancement Over Normalizing Process

The process is a refinement and advancement of the normalized process. In air-tight vessels the steel stock is heated under the action of controlled atmospheres to produce a structure and surface necessary to withstand the severe and drastic cold upsetting of wire to be made for recessed heads of all types. After this special heat treatment, the stock is drawn through a special lubricant to an intermediate wire size and then carefully annealed in process before the final drafting to the desired final wire size.

Available in 12 Grades of Steel

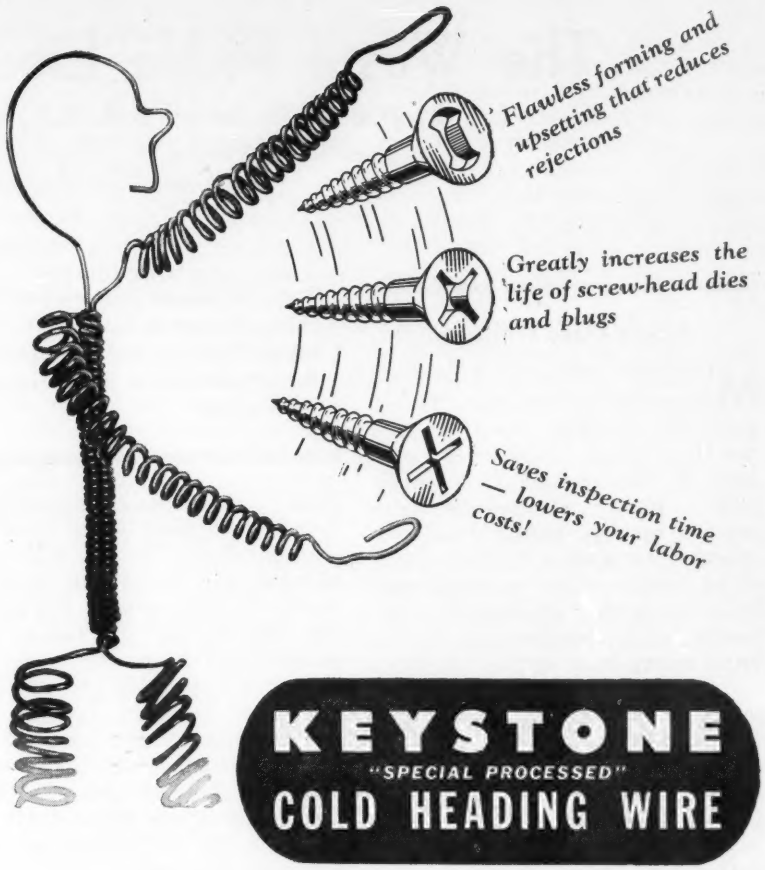
Keystone's new wire for recessed head screws is furnished in the following steel grades:

C-1006	C-1016
C-1008	C-1017
C-1010	C-1018
C-1012	C-1019
C-1013	C-1020
C-1015	C-1022

It can be used in the cold upsetting of round, flat, oval, fillister, truss, binding, pan, hexagon, and slotted recessed Phillips and Clutch Head Machine Screws, Sheet Metal Screws, Cut Screws, and Self-Tapping Screws.

Many Advantages

The cold heading industry benefits greatly from this new wire developed by Keystone . . . in increased life of dies and plugs, in reduced rejections, in less machine down time, and in savings of cost of expensive final inspection as well as a better finished product.


Flawless forming and upsetting that reduces rejections
Greatly increases the life of screw-head dies and plugs
Saves inspection time — lowers your labor costs!
KEYSTONE
"SPECIAL PROCESSED"
COLD HEADING WIRE

For recessed heads, Keystone's new special-process wire delivers the desired upsetting and die forming qualities with such a high degree of uniformity that finished product rejections are practically eliminated . . . individual inspection of screws is no longer necessary . . . die and plug life are often more than doubled. This new wire effects considerable savings in the production of Phillips head, clutch head and cross recessed head screws.

Keystone is prepared to help solve any of your industrial wire problems. If special treatment is called for, Keystone's metallurgical research and testing facilities are available to supply the answers. We welcome your inquiry.

KEYSTONE STEEL & WIRE CO.
PEORIA . . . ILLINOIS

Special Analysis Wire, Setting New Standards of Performance

The Waste Pickle Liquor Problem

By Wallace G. Imhoff, B.A., B.S., M.S., Met.E.,
President, Wallace G. Imhoff Company,
Los Angeles, California

Part I.

Part I of a paper presented at the Wire Association Convention October, 1949, in Chicago, Illinois. Part II will follow in the December, 1949, issue.

People Make Problems

MODERN industrial problems have become serious mainly for two reasons, first, because of the almost sudden appearance on the horizon of so many human beings everywhere; and second, because industry is now operated on such a gigantic scale of production, that its wastes and by-products have reached the menace to human beings stage in the cities where most of the industries and people of the country are located. The cost of the destruction of property, homes, buildings, city sewers, pollution of the streams endangering public health, and contaminating drinking water, and recently the alarming state of suffocation from fumes, smog, and poisonous gases poured out into the air, has become a serious threat to the lives and welfare of those living near these plants.

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SOME idea of what has happened in approximately the past seventy-five years may be seen from the following figures. In 1875 the population of the United States was approximately 38 million people; by 1900 it had doubled, 76 million people; in 1920 it had reached 106 million; in 1940 there were 132 million; and by 1950 it will be approximately 150 million people. Thus in 75 years the number of human beings in the United States has multiplied from 38 million to 150 millions of people. These figures illustrate how the appearance of millions of people make the proper handling and control of industrial wastes a serious problem.

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NOW while the number of human beings increased, industry itself has grown past even the giant size to the colossal stage. To give some idea of what that means in terms of wastes run into sewers, and poured out into the air the following is quoted from an editorial in the Los Angeles Daily News under date of November 11, 1948. It is from a report made by **Dr. Louis C. McCabe,** Director of the County's Air Pollution Control District. After the results of months of study and analysis, Dr. McCabe states, "that 822 tons of sulfur dioxide enters the Los Angeles atmosphere every day." Ten years ago, November 1939, **Dr. Willard W. Hodge,** in his paper, "Wastes Problems of the Iron and Steel Industries", stated,

> **"Estimates of the total annual production of waste pickle liquors in the United States vary from 500,000,000 to 800,000,000 gallons, which indicates the real magnitude of the problem," and that was before the war. A conservative figure during the war would have been probably 1,000,000,000 gallons of waste pickle liquors."**

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Early Pickling

THE waste pickle liquor problems of today had very obscure and humble beginnings. In contrast to the conditions just cited, there were very few people, there were vast open spaces everywhere, and the waste pickle liquor was produced in small quantities. **Edwin D. Martin,** in his paper, "Continuous Strip Pickling", gives such a vivid and interesting account of early pickling, that to quote his description is the best way to visualize the historical background for this discussion of "The Waste Pickle Liquor Problem":

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"THE 18th Century saw the development and early use of the hot dip tin plate process. Gross scale removed from hammered or hot rolled steel was accomplished by laborious hand rubbing with sandstone. Then followed the secret treatments in the best form of the Alchemists. The sheets were pickled by immersing for several days in one of various unappetizing solutions made up by fermenting grains, particularly barley. Solutions such as vinegar, beer, or wine also were used for this purpose. This was followed by washing with water and sand. It is likely that the present term 'pickling' for scale removal from metals with acids originated from the old use of vinegar. An interesting account of pickling practice in Bohemia in 1757 was given by G. Jars in a book entitled, 'Metallurgical Travels'. The wrought iron sheets were pickled in successive barrels of water soured with rye flour; first in old rye water for 24 hours, then in fresh rye water for another 24 hours, and finally for 24 hours in very old rye water, 'into which there was thrown about a hatful of flour every two weeks'. The chamber containing these barrels was heated by a charcoal stove to accelerate the pickling."

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"THE use of dilute sulfuric acid for pickling sheets was not adopted until 1806, when its pro-

duction had reached a sufficient commercial scale to permit it to be used at a low cost. Reamur, the French physicist, had suggested its use many years before, but its application was limited by its high cost. Some hydrochloric acid had been used as early as 1760, to acidify the fermented grain mixture, but it also had limited use due to high cost. The use of sulfuric acid as an acidifying agent for the fermented grain solutions followed closely, and in the early 19th Century the practice was to immerse the steel sheets in a bath of fermented barley for 24 hours, then steep them in a bath of two pints of oil of vitriol to two gallons of water, and finally scour with sand."

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AN early account of the use of sulfuric acid was given in a paper published in 1818 by **Samuel Parkes.** The sheets were prepared for tinning by pickling or 'working' in the 'lies'. The lies consisted of water in which bran had been steeped for some time. The sheets were allowed to remain for about 12 hours in the lies, and then were placed in dilute acid contained in a lead box. Treatment for about one hour with agitation gave the sheets a perfectly bright surface. Parkes remarks, "that some nicety, however, is required in this operation for, if they remained too long in the acid, they would become stained or blistered by it... one of the most difficult parts of the business, as few men like to work in it, though I understand that a good pickler is highly valued by his employers and obtains great wages." It mentioned that a temperature of 90-100 degrees F. was sufficient; so that in summer little additional heat was found to be necessary.

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IN 1829, **Morgan** in England, patented the use of sulfuric acid. Steam heated pickling vats were used in 1850; pickling machines were foreshadowed in a patent in 1863 and in 1870 pickling machines superceded hand labor. From this time until 1910, development in the pickling process was limited to mechanical devices; 'batch picklers' were developed.

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THEN came the development of coil pickling, and in 1913 a continuous strip pickler was developed. The tanks which had been arranged in a circle changed to much longer and larger tanks that held very much larger volume of acid solution. More and more waste pickle liquor came into being, with the increasing problems of how to dispose of it. The same excellent authority in commenting on modern pickling practice says:

"Sulfuric acid is commonly used for pickling, due principally to its low cost. The pickling solution varies in strength, ranging from 6 to 26 per cent by volume of 100 per cent acid. The solutions are maintained at temperatures ranging from 190-210 degrees F. Higher temperatures are preferable since the pickling rates are greatly increased with increased temperature. While inhibitors have been used in continuous picklers the practice varies with different operators."

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"As pickling progresses, the activity of the bath gradually decreases due to the presence of an increasing quantity of dissolved iron sulfate. As the iron sulfate formed increases, the acid strength decreases. Fresh acid must be added to maintain the desired bath strength. The acid concentration is maintained in this manner until the solution reaches a gravity of 22-25 deg. Bé which, in low acid strength pickling, indicates an iron sulfate content of approximately 300 grams to the liter. At this point the batch is inactive, and the pickling speed is usually reduced to the base speed of the line, around 60-90 feet per minute. At this point no further acid is added; the acid content is allowed to drop to 2 per cent by volume of 100 per cent sulfuric acid. It is the usual practice to dump the solution at this point, and make up a new solution. The spent solutions are normally dumped before the iron sulfate content reaches saturation point, where it will start to crystallize out in the pickling tanks. If this occurs it results in hard crystals of iron sulfate heptahydrate ($FeSO_4 \cdot 7 H_2O$) which are difficult to remove. In some instances these crystals have to be broken up by pick and shovel or by light blasting."

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Waste Pickle Liquor

LONG before the wastes and by-products of industry were produced on such a gigantic scale as today, in our modern plants of mass production, skilled chemists and engineers in the iron and steel industries, and in chemical industries were searching for methods to utilize the ingredients in the liquors. The destructive qualities of waste pickle liquors were recognized early in the passing of laws in small towns and villages to prohibit the dumping of these acid liquors into small streams and brooks. Records in the English Patent Office for the period 1856-1920, Class 2, Part 2, contain patents on recovery of spent pickle liquors at a very early date. In 1883 **Howell** obtained a patent on the "Improvement in the Treatment of the Waste Liquor Produced in Pickling Iron", and **Kirkman, Bowen,** and **Parker** were granted patents in England for treating acid waste liquors from pickling iron. The important thing to be noted here is that the problem was recognized at such an early date. The destructive action of the acids used, hydrochloric acid was also used to considerable extent, was recognized at once, but the motive for obtaining patents on the treating of the waste liquors was probably more from the commercial angle than as a menace to public health and human interests at that time.

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PRODUCTION of iron and steel rose gradually up to 1895, and it is from this time on until today that the production has risen to a capacity of 96,000,000 tons in 1949, and with one third of the steel made so far in this century having been turned out since 1937. Once again it is not only interesting, but very enlightening to reveal the steel production in relation to the population in the United States. In 1900 the production of steel was 11,410,928 net tons with a population of 76.1 millions of people. By 1920 steel production had risen to 47,188,886 net tons, and the population was 160.5 million people. Twenty years later in 1940 steel production had risen to 66,982,686 net tons and the population was 132 millions of people; in 1948 steel production was 88,533,729 net tons, and the population 146.1 millions of people. It is very important in this discussion to call attention to the fact that an ex-

tremely large percentage of this population is located in the cities of the United States, and in nearby towns, where our great industrial plants are located. Thus we have the waste pickle liquor problem aggravated by at least three modern conditions; 1. Heavily populated cities; 2. Tremendous production of iron and steel much of which is cleaned and processed by pickling; and 3. The enormous quantities of waste acids produced and to be gotten rid of efficiently.

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Why the Disposal of Waste Pickle Liquor Is a Real Problem

THERE probably is no other problem in the iron and steel and chemical industries that is more difficult to solve, and that has received more study than this one of satisfactorily handling and disposing of these waste acids from pickling. It is therefore of passing interest to reveal why the problem is so difficult to solve. First there is a tremendous solution volume of these liquors; perhaps 1,000,000,000 gallons in 1943 the peak year of steel production during the late war. Second, the acid content is small, and the iron content in the form of ferrous sulfate, does not offer any attractive return commercially for the treating of this enormous volume of waste. Third, the problem is complicated considerably by the waste liquors in many plants, especially the plating industry, carrying other chemicals, and chemical compounds. 4. It is a very difficult problem to find a paying market or outlet for the products made in treating these liquors. 5. The market for pigments is limited, and only a small part of the waste liquors can be used. 6. The size of the plants is in many instances beyond the small operator. 7. The cost of the plant is excessive for most small operators. 8. The equipment involved in many cases is far too expensive and too complicated for plants not having a large amount of waste liquor. 9. The methods in many patents are very complicated, and the technical requirements too great. 10. In some methods large areas for ponds, tanks, etc. are required. 11. Pyramiding costs in many methods far exceed the value of any by-products that can be recovered. 12. The first cost of installation is too great for any but large corporations. 13. There is always the problem of huge water volume. 14. Many methods have a requirement that can come only from large production, and continuous operation. 15. In many methods the costs of operation are so high, the equipment required is so involved, that to handle and treat waste pickle liquors means almost adding a chemical manufacturing business to the company.

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A General Discussion of Present Methods

IN considering any discussion of any kind relative to waste pickle liquors, the very first thing that should be done is to separate plating waste liquors from the usual pickle liquors that are from steel plants and chemical industries. This discussion does not deal with plating waste liquors at all, since that field requires its own methods and entirely different treatments for some of the waste liquors of different chemical composition.

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THE early waste pickle liquors were in a great many cases wastes from hydrochloric acid pickling, but they gave way to the ever growing use of sulfuric, and today the muriatic waste liquors are in very small volume as compared to the waste liquor from sulfuric acid pickling. In some plants the muriatic acid waste is so small in volume that both acids are disposed of together.

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A REVIEW of the many patents and methods for treating and handling waste pickle liquors in the past fifty to sixty years is indeed a gigantic task. The methods range from the easiest way of disposing of the liquor which is to run it into the sewers, or down into old wells, sumps, etc., to plants that cost up to five and six figures, with complicated and expensive methods and equipment for treating the liquors. Beginning years ago with simply disposing of the liquor in any way possible, through the small equipment known as "The Witches Cauldron" then to the medium scale plants involving small chemical outlay, there are today many large and expensive plants using complicated equipment, and expensive chemical processes. To describe, even a small number of the processes and methods now available, is impossible in a paper of this type. The purpose is rather to lump them all into a common background for the purpose of seeing just how far science has progressed in really solving this waste pickle liquor problem.

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THE very fact that the problem seems to be still with us, and an urgent one awaiting a simple practical solution, indicates that up to the present time none of the processes or methods have met all the needs in the industry. The one fact that seems to stand out clearly is that most of methods and processes are beyond the small plant, and suggest almost adding a growing chemical department or company to the plant. Most small plants have been hoping for a solution that is simple, inexpensive, not involving a lot of complicated equipment, and one that is within their reach both from a cost standpoint, and skill required for the operators. Most treatments require at least a chemist, many a staff of engineers, and others a whole separate plant with special equipment, a number of engineers and operators, and special chemical methods. The later processes require a heavy initial first cost plant installation, and generally the operating expenses are heavy from both manpower and equipment standpoints. In other methods the precipitates and sludges made are in such large quantities that there is not only an additional problem of disposal place to put them created, but the costs added are also a vital problem to be considered. In still other processes the products developed have very

limited commercial value, and the market outlet is very small, and the sales limited.

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What May Be the Simplest Solution of the Problem

THE question now is—"Is there a simple solution of the problem, and if so in what direction do the prospects appear best?" There at least appears to be a few vital points that are practical to think about in attemping to solve this waste pickle liquor problem in a manner that even the small plant can use. The first one would seem to consider only those methods that do not complicate the undertaking by adding more and more materials, and more and more equipment by pyramiding the materials used in the different steps of the process. For example, the waste pickle liquors contain iron in solution as ferrous sulfate. It is made up of two components —iron and sulfate. Most liquors contain some free sulfuric acid, a third component. There is always an extremely large volume of water present, a fourth component. Finally there is the ferrous sulfate. In its simplest form then the problem of handling and treating waste pickle liquors revolves about these components. They may be listed as follows:-

1. **Developing a method that will take the iron out of the liquor as the element iron.**
2. **Developing a method that will remove the ferrous sulfate as ferrous sulfate, leaving the acid.**
3. **Developing a method to regenerate the acid.**
4. **For continuous operation developing a method that will remove the ferrous sulfate as fast as it is formed, and after regenerating the acid content return it to the tanks for further pickling action.**

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THE real problem now involved becomes one of using such equipment, such methods, and such processes that will not add any additional materials to the liquor, but which by the new method or treatment, will remove the ferrous sulfate and return the good acid to be used over again in pickling, after it has been regenerated. Any method that will take out the iron from the ferrous sulfate, and leave the acid intact for further pickling would also solve the problem. The ideal process might be compared to a purifying system where the large volume of waste liquor enters at one end of the system, and good acid is returned from the discharge end, with the ferrous sulfate being removed somewhere on the way. Even small plants could use a simple practical method that would appear to simply filter out the ferrous sulfate, and return the good acid for reuse. It is evident immediately that if such a treatment could be found, that it would eliminate the handling of large precipitates, the disposal of sludges, and end what might be termed, "the pyramiding" of treatments, materials, and processes, sometimes involving extremely costly equipment, and complicated chemical operations and treatments, which finally turn out end products that it is difficult to find commercial markets for, or that can only handle and treat a very small proportion of the total volume of waste pickle liquor produced.

★ ★ ★

Patents

Year

1883 Howell, L. Tailbach, "Improvement in the Treatment of the Waste Liquor Produced in Pickling Iron." This patent is discussed in the Journal of the Society Chem. Ind., Vol. 2, page 477. These improvements consist in evaporating the waste liquor to dryness and furnacing the residue, so as to obtain vapor of hydrochloric acid gas, which can be condensed in the usual way; and ferric oxide.

1887 Dec. 30 M. N. d'Andria, Salford. "Improvements in Treating Liquid Acid Residues from Galvanizing Works to Obtain Products Therefrom." Eng. Pat. 17,909. Dec. 30, 1887. Jour. Soc. Chem. Ind., Vol. 8, p. 52.

1888 Mar. 3 Bowen, Ebenezer. Pontardulais. British Patent, 3,179 of March 3, 1888. Improved Economic Treatment of Certain By-Products of Gas and Tin-Plate Manufacturers. 4d Jour. Soc. Chem. Ind., Vol. 8, page 193.

1888 Sept. 29 Kirkman, H. J., Swansea. British Patent No. 14, 061, of Sept. 29, 1888. "Improvements in the Utilization of Waste Pickle from Tinning and Galvanizing Works." 4d Jour. Chem. Ind. Vol. 8, p. 400.

1888 Nov. 8 Turner, Thomas. Birmingham. Patent No. 16,166 of Nov. 8, 1888. "Treatment of Waste Liquors from Galvanizing Works." 4d Jour. Soc. Chem. Ind. Vol. 8, page 780.

1888 Nov. 9 Kirkman, H. J., Swansea. British Patent No. 16,247 of Nov. 9, 1888. "Improvements in the Utilization of Waste Pickle from Tinning and Galvanizing Works." 6d Jour. Soc. Chem. Ind. Vol. 8, page 548.

1889 Turner, Thomas. British Patent No. 9,225 of 1889. "Improvement in the Treatment of Waste Pickle from Galvanizing Works."

1889 Greenway, A. G. British Patent No. 9,680 of 1889. "Improvements in Galvanizing Iron and in Utilizing the Waste Acids Therefrom."

1889 Parker, T., and Robinson, A. E. British Patent No. 10,554 of 1889. "Improvements in the Connected with the Utilization of Sulphate of Iron Galvanizing Pickle."

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1894 Emmens, S. H., U. S. Patent No. 513,490 (1894).

1895 Emmens, S. H., U. S. Patent No. 543,002 (1895).

1897 Sill, T. T., British Patent No. 10,509 (1897). "Improvements in the Manufacture of Red Oxide from Waste Liquors from Galvanizing Works." Production of red oxide for use in the manufacture of paints.

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1902 Crossley, F. D., British Patent 7,832 of 1902. "Improvements in the Treatment of Spent Iron Pickling or Cleaning Liquors or Other Solutions Containing Sulphate or Chloride of Iron, for Obtaining Sulphate or Chloride of Iron or Other Useful Products Therefrom."

1904 Davis, G. E. British Patent Application 24,156 of 1904 (Abandoned).

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1908 Davis, G. E., and Fearon. British Patent No. 25,024.

1908 Bloxam, A. G., British Patent No. 27,353 of 1908. "Improvements in Pickling Metals." Relates chiefly to the recovery of ferrous sulphate from spent pickle liquors.

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1910 Falding, F. J., and Cathcart, W. R., British Patent 11,364 of 1910. "Improved Process for the Recovery of Valuable Products from Pickle Liquor and Gas Liquor. The same U. S. Patent No. 961,764.

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1911 Farnham, F. F., U. S. Patent No. 1,006,836. "Process and Apparatus for Electrolytic Recovery of Waste Liquor." Met. & Chem. Eng. Oct. 12, 1911, p. 670. Free acid is neutralized with scrap iron, and iron salts crystallized producing copperas (ferrous sulphate of commerce). Assigned to Arthur D. Little, Inc., Newton, Mass.

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1917 Hoffman, Addison F., and Parkin, Wm. M., U. S. Patent No. 1,269,441. "Recovering Values from Pickling Metals." Waste sulphuric acid pickle liquor is freed from suspended solid impurities by sedimentation, concentrated, and the ferrous sulphate is crystallized out.

1917 (?) Hoffman, Addison F., U. S. Patent No. 1,269,442. "Process of Producing By-Products from Waste Pickle Liquors." Relates to the regeneration of spent liquor by oxidation with air and manganese dioxide or other manganese compounds.

1918 (?) Fireman. Peter, U. S. Patent No. 1,287,939. "Utilization of Sulphuric Acid Pickle Liquors." Liquor is neutralized with scrap iron or calcium oxide, the resultant iron sulphate is treated with calcium chloride and the ferrous chloride solution obtained is treated with calcium hydroxide to regenerate the calcium and produce a precipitate of ferrous hydroxide.

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1922 Travers, J. T., U. S. Patents 1,440,253-4; (1922).

1922 Aug. 29 Hilpert, S. U. S. Patent No. 1,427,386; Aug. 29, 1922. "Acid Treatment of Waste Sulphuric Acid."

1923 Apr. 3 Marsh, Henry S., and Cochran, Ralph S., Youngstown, Ohio. Granted April 3, 1923. U. S. Patent 1,450,216 and 1,450,217. "Method and Apparatus for Recovering Spent Pickling Solutions."

Pat. 1,450,216—The method described of reclaiming spent pickling solution, which consists in causing the solution to flow in a looped circuit, the return branch of the circuit confined within heat-conducting walls being submerged in the outgoing branch, and cooling the stream in the loop of the circuit.

Pat. 1,450,217—An apparatus for unburdening a solvent of its load of salt, a loop formed conduit, with branches in heat exchanging relation one to the other, cooling means arranged at a point intermediate the length of the inflowing branch of the conduit, a second cooling means arranged in the loop of the conduit, and a separating means arranged in the loop of the conduit beyond the cooling means last mentioned substantially as described.

1923 Dec. 18 Leaver, E. S., United States Patent No. 1,477,965; December 18, 1923. "Making Solutions Containing Sulphuric Acid and Ferric Sulphate.

1924 Nov. 18 Stevenson, Earl P., U. S. Pat. 1,515,799; Nov. 18, 1924. "Method of Treating Spent Pickle Liquors." A process of treating spent pickling liquors which comprises bringing a hot saturated solution of pickling liquor into direct and intimate contact with air at a materially lower temperature and in sufficiently large quantity to affect substantial absorption of water from the pickling liquor.

1925 Jan. 27 Hoffman, A. F., and Parkin, Wm. M., U. S. Patent No. 1,524,435; January 27, 1925. "Pickle Liquor and Process."

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(*Please turn to page* 1058)

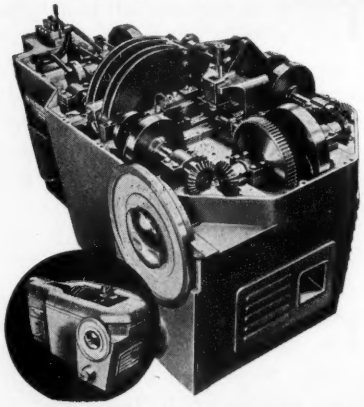
Produces 18,000 wire parts per hour!

The MACNAMARA M.I.3

WIRE FORMING MACHINE

HERE's the machine to increase your production of formed wire parts. As simple to set up and operate as a sewing machine, it will produce a vast range of wire shapes at the rate of 18,000 parts an hour, for as long as you wish. So simple are the controls that one operator can easily supervise six machines, stepping up production to 108,000 parts from one operator per hour.

The machine can handle non-ferrous wire up to 0·080″ dia. and steel wire up to 0·064″ dia. There's also a model for producing completed chain at the rate of 12,000 links per hour.



For strip forming

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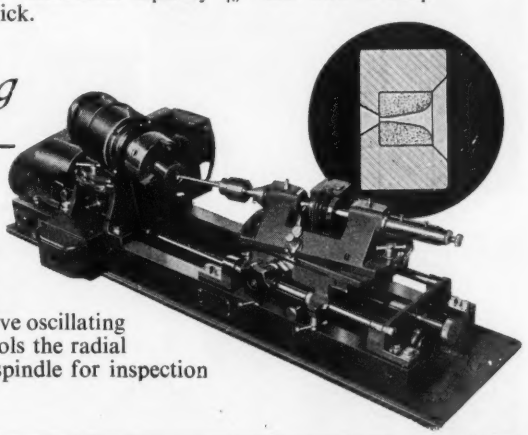
DESIGNED to produce simple or complex forms from continuous self-feeding coiled stock, this machine eliminates separate press operations and cuts handling costs by over 80%.

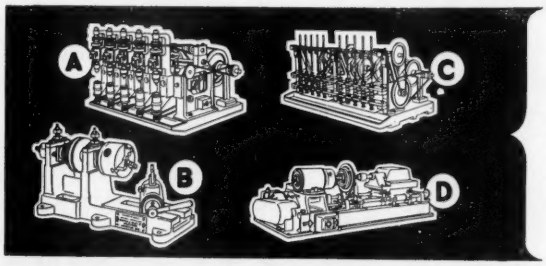
An infinite variety of wire and strip forms can be produced at an average rate of 9,000 parts per hour. Maximum capacity $\frac{3}{16}$″ dia. wire or strip material $1\frac{1}{2}$″ wide by $\frac{1}{16}$″ thick.

For die piercing and polishing—



THE RUDKIN AND RILEY HIGH SPEED UNIVERSAL LAPPING AND POLISHING MACHINE, TYPE 2015/I

FINE or coarse parallel bores, precise tapers, angles and radii are all produced faster and automatically on this machine. It has a high rate of carbide removal and bores angles and radius operations in one setting. The unique positive oscillating device is adjustable for pressure, a quick-acting clutch controls the radial head and the headstock can be swung clear of the needle spindle for inspection and hand polishing. Available with 4″ and 8″ chucks.



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A. Five-Head Vertical Piercing and Polishing Machine for Diamond and Tungsten Carbide Dies.
B. Hand-Polishing Machine for Diamond and Tungsten Carbide Dies.
C. Ten-Head Diamond Die Polishing Machine.
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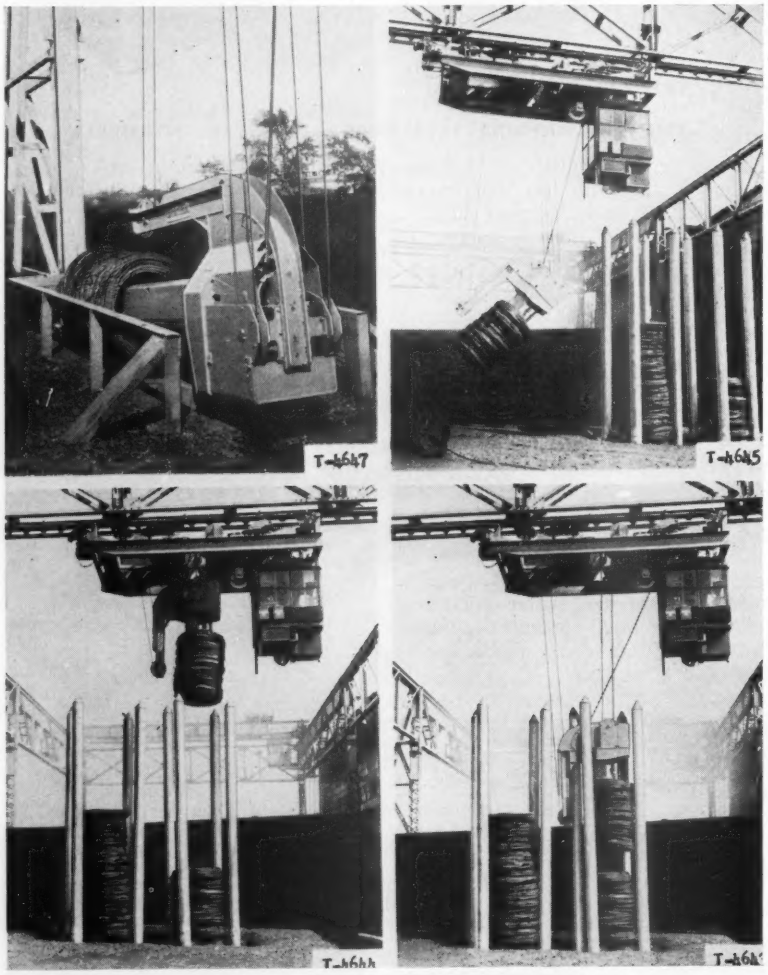
Cleveland Tramrail Vertical Stacking Hairpin Hook and Carrier

THE storage capacity of a warehouse for rod or wire can be increased approximately 25% by means of a new Vertical Stacking Hairpin Hook and Carrier developed by the **Cleveland Tramrail Division of The Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

★ ★ ★

PERHAPS of even greater importance is the fact that it is possible to maintain separation of rod and wire by sizes and alloys because of vertical piling. In some instances more than 100 sizes and alloys must be kept in stock.

★ ★ ★



THE new Cleveland Tramrail vertical stacking unit will handle 10 coils of 330 pounds each, or 3300 pounds total, at a time, picking them from horizontal position on floor or in gondola car and placing them in vertical piles supported by floor posts as illustrated. The unit will also lift off the coils from the vertical piles and place them into a horizontal position.

★ ★ ★

THE grab mechanism is actuated by a built-in hydraulic pump which causes a spreader plate to expand or retract. In the expanded position, sufficient pressure is exerted against the inside diameter of the coils to hold them firmly during handling.

★ ★ ★

THE first installation of the equipment has just been completed. It is in a building with a truss height of 40 feet. Rod will be stored to a height of 22 feet.

★ ★ ★

ALL motions of overhead carrier or crane and the hook are controlled from crane operator's cab. It is entirely possible for the operator to maintain records in his crane cab of entries and withdrawals and thus keep a perpetual record of rod or wire in the warehouse.

★ ★ ★

AT left the new vertical hook and carrier is shown in operation. The four views illustrate its practical uses.

★ ★ ★

Wire Rope for UN Building

FIRST reels of the 20 miles of wire rope for elevators in the United Nations Secretariat Building in New York, were delivered Friday, July 22nd from the plant in Trenton, N. J., of U. S. Steel's **American Steel and Wire Company,** where it is being made.

★ ★ ★

IT is estimated that 40,256 persons will be transported daily in the 18-passenger elevators in the 39-story structure. Each car will be hoisted by six ropes, each having a breaking strength of 30,000 pounds. The capacity per car will be 3,500 pounds or 23 persons. The elevators will travel a total of 414 car miles a day.

★ ★ ★

IN addition to the passenger elevators, the building will have two high-speed service cars and one heavy-duty freight elevator.

★ ★ ★

THE cars will operate on 31,612 feet of elevator rails. They were rolled by Carnegie-Illinois Steel Corporation, another subsidiary of U. S. Steel. The rails were machined in the Harrison, N. J., plant of the Otis Elevator Company, which holds the contract for manufacturing and installing the 21 elevators and eight escalators in the building.

★ ★ ★

Discuss Aluminum Nails to Fix Specifications for Army Use

DATA required in fixing specifications for non-corrosive aluminum nails that may be flown in government planes for use in installations in Alaska and other points was submitted at a conference of government officials and representatives of the aluminum industry at the **Nichols Wire & Aluminum Co.** plant in Davenport.

★ ★ ★

ATTENDING the conference were **O. M. Mader,** Pittsburgh, research engineer for Aluminum Company of America; **Charles Walte,** manager of the farm development division of Reynolds Metals Company, Louisville, Kentucky, and **John A. Scholten,** research engineer for Forest Products Laboratory, Madison, Wisconsin. Forest Products Laboratory is operated by the U. S. Department of Agriculture.

★ ★ ★

ALSO taking part in the conference were **Frank R. Nichols,** president, and **Frank Leahey,** executive vice president of Nichols Wire & Aluminum Co.

★ ★ ★

THE conference was held at the suggestion of the Army Dept. since absence of specifications for aluminum nails has prevented their use by the government up to now. The fact that they are non-corrosive, and that they may be transported by plane in greater quantity than steel nails, (three to one ratio) make them desirable cargo, it was pointed out.

★ ★ ★

THE Nichols plant was chosen as the scene of the conference

MICROMETER PRECISION

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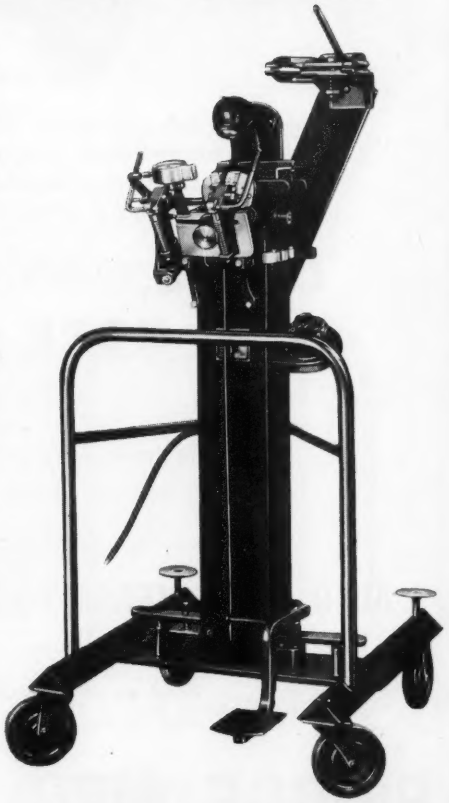
MODELS J-3-S and J-4-S AUTOMATIC MICRO-WELD BUTT WELDERS



These welders are used for welding high and low carbon STEEL, and STEEL ALLOY wire, ranging in size from .020" to .160" diameter. All operations on these units, which include the clamping of the wire being welded, contacting the welding switch, and upsetting the weld, are made by a single downward stroke of the foot pedal. Welders for high carbon steel wire are equipped with the exclusive MICRO-WELD Dial indicating annealing device to facilitate the annealing operation on high carbon wire.

Standard equipment with these units include annealing dies, filing vise, light extension cord, and mounted on a 4-wheel truck. Special units can be furnished for crane mounting.

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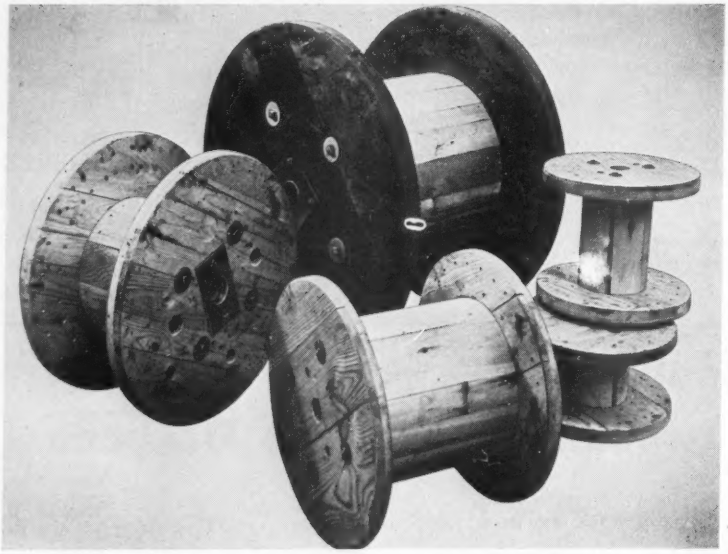

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because it is the largest in the United States from the standpoint of equipment in the manufacture of aluminum nails.

★ ★ ★

DATA presented will be assembled and classified, after which it will be submitted to aluminum producers and other manufacturers of aluminum nails for their approval. Final certification of the specifications will be made by the Specifications Board in Washington.

★ ★ ★

Semi-Automatic Spring-Coiling Machine

A SEMI-AUTOMATIC machine for winding both left-hand and right-hand compression, extension and torsion springs is being marketed by **The Carlson Company,** 277 Broadway, New York 7, N. Y. The machine is especially useful for coiling small quantities of springs (up to about 100), and for making samples. The set-up time is only a few minutes and an operator can usually complete between 25 to 35 small-lot orders per day. Springs may be wound from spring steel, music wire, stainless steel, phosphor bronze or any other spring material.

★ ★ ★

IT comes equipped with an arbor rack, containing 29 arbors made from ground, polished and hardened drill rods in sizes from 1/16 inch to ½ inch diameters advancing by 64ths. Three coiling points made from hardened tool steel, an extra wire holder for heavy wire and a wire cutter are also included.

★ ★ ★

THE Carlson Spring-Coiler No. 1 will handle wire diameters up to 0.063 inch, and will coil springs up to ¾ inch diameter; however, larger outside diameters are obtainable with special arbors. Springs up to 4 inches in over-all length and up to 25 coils can be produced; pitches are adjustable from zero up to a wide range. The end coils of compression springs are closed or squared automatically, and the springs are wound with

a uniform pitch and to an exact length. Extended lengths for forming special ends or hooks can be made. The machine is hand-operated but a motorized unit can be added if desired.

★ ★ ★

ONE turn of the handle produces three coils. Left-hand springs are made on the inner shaft, and right-hand springs are made on the outer shaft. The lower bar is adjustable horizontally to determine length. The long cam is adjustable at various angles to determine pitch. The short cam and distance from roller to long cam are adjustable to make any number of closed coils from one-half coil to three. The position and movement of the rack is adjustable to determine the number of coils. Arbors determine the spring diameters and a friction holding device on the tool post is adjustable to grip the wire. Complete instructions covering installation, operation and set-up are supplied with each machine.

★ ★ ★

THE machine is precision made. Material is best quality cold rolled steel for baseplates, gear box, and supports. Hardened tool-steel guides are used for slides and coiling points. All shafts revolve in bronze bushings. The machine is enameled in a machinery gray finish. Each machine is assembled, inspected and tested before shipment. Sizes are as follows: baseplate, 4 x 15 inches; height of gear box, 5-⅝ inches; length of long cam, 29 inches; and net weight (approximately), 25 pounds.

★ ★ ★

When you write an ADVERTISER for prices and information, PLEASE MENTION the fact that you saw his ad in WIRE AND WIRE PRODUCTS. It identifies your inquiry and expedites service.

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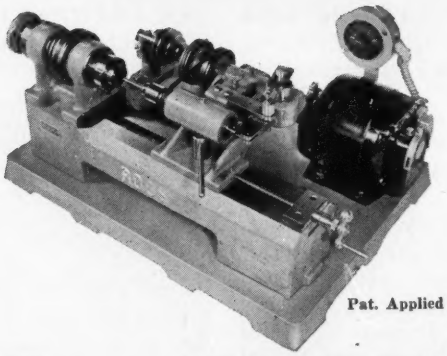
For the Die Room



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  More dies per day.
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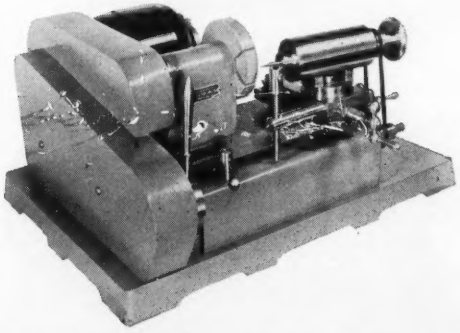
Roos Precision Pin Grinder



A machine that any Die Room employee can operate and make the finest lapping pins in less time and at less cost than a skilled mechanic.

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Outstanding Personalities of the Wire Industry

Glenn L. Martin Company Elects Three New Directors

ELECTION of three new members of **The Glenn L. Martin Company's** Board of Directors was announced after the Board's September meeting at Baltimore, Md.

★ ★ ★

THEY are **Harvey J. Gunderson,** a director of the Reconstruction Finance Corporation, Washington, D. C., **Chester F. Hockley,** president of the Davison Chemical Corporation, Baltimore, and **Daniel A. Evatt,** vice president-finance of the Martin Company.

★ ★ ★

PRINCIPAL officers of the company, in addition to Mr. Martin, Mr. Pearson and Mr. Evatt, are **G. T. Willey,** vice president-manufacturing; **D. R. Shoults,** vice president-engineering; **Robert H. Kittner,** vice president-Chemicals Division; **Joseph C. Little** of Jones, Day, Cockley and Reavis, Cleveland, Ohio, secretary; **Earl R. Uhlig,** controller, and **William L. Lucas,** treasurer. Mr. Willey and Mr. Little previously also served on the Board of Directors.

★ ★ ★

Universal-Cyclops Steel Corporation Appointments

UNIVERSAL-CYCLOPS STEEL CORP., Bridgeville, Pa., announces that **G. B. LeVan** has been appointed general manager, and **E. H. Broadhurst,** works manager of its Cyclops Division plant at Titusville, Pa., where for several years Mr. LeVan has been assistant general manager, and Mr. Broadhurst, superintendent.

★ ★ ★

Roebling Company Opens New Warehouse in Denver

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., nationally-known manufacturers of wire products, has announced the opening of a new Denver, Colorado office and warehouse.

★ ★ ★

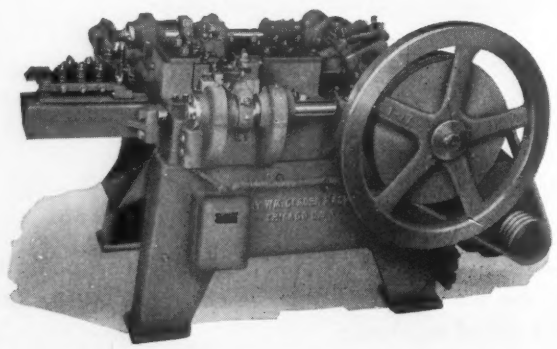
THE new building, located at 4801 Jackson St., is modern in every respect and was designed to provide unusual warehousing facilities to expedite service to their agents and customers.

★ ★ ★

HOMER H. DAVIS, who has represented the Roebling Company in the Denver area for 23 years, will serve as manager, with **Roy H. Hainsworth** acting as his assistant. **Fred L. McLean** will be in charge of oil field sales.

★ ★ ★

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

J. E. Brown Appointment Announced by A S & W

APPOINTMENT of **James E. Brown** to a newly-created position of assistant general superintendent of **American Steel & Wire Company's** Cuyahoga Works has been announced by **A. J. Hoyt,** Cleveland district manager of operations for this U. S. Steel subsidiary.

★ ★ ★

MR. BROWN, a veteran of 20 years' service with American Steel & Wire, moves to his new assignment from the staff of **H. B. Jordan,** vice president-operations of the company. He will serve as assistant to **H. L. Jenter,** general superintendent of Cuyahoga Works, largest of the five wire Company plants in the Cleveland area.

★ ★ ★

STARTING as a weigher in the company's Newburgh Wire Works in 1930, Mr. Brown later became a tester and wire drawer, advancing to the position of general foreman at the same plant. He spent two years at Cuyahoga Works, returning to Newburgh in 1945 as works superintendent. In 1947 he was transferred to Mr. Jordan's staff.

★ ★ ★

JAMES E. BROWN
Asst. General Superintendent Cuyahoga Works, American Steel & Wire Co., Cleveland, O.

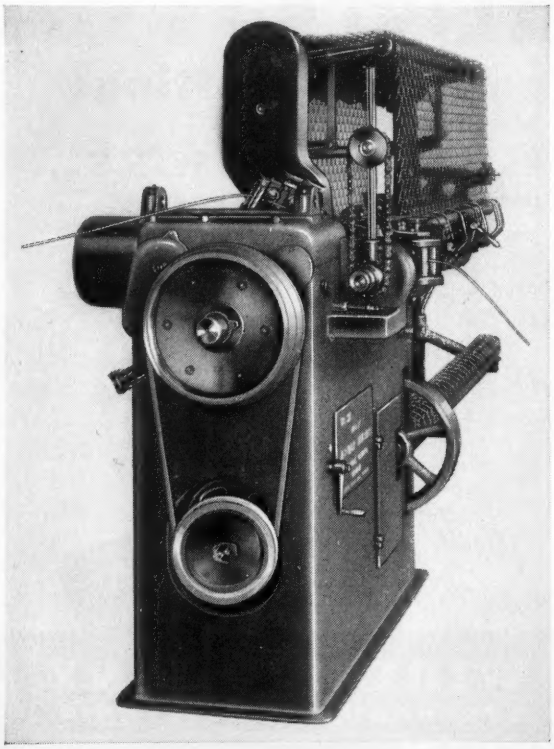
S. H. Wardell Now Director of Mill Operations for American Brass Co.

SYDNEY H. WARDELL, works manager of the Detroit branch of the **American Brass Company,** has been named director of mill operations for the entire company. He succeeds **William M. Moffatt,** of Waterbury, who was promoted to vice president in charge of manufacturing. Mr. Wardell will establish his headquarters in Waterbury.

★ ★ ★

MR. WARDELL entered the employ of the Buffalo Copper & Brass Rolling Mills in 1915. The company was subsequently purchased by the American Brass Co. In 1920 he was transferred from Buffalo to Waterbury and assigned to the general production department. He became superintendent of the Detroit branch in 1927 and was subsequently promoted to works manager.

★ ★ ★



CHAIN-LINK FENCE
Woven At Pre-war Costs

Weekly output increase 50% or more.

Weaving cost per roll 50% less (power, space, labour saved with bigger output).

Gears of machine cut, hardened Alloy Steel run in oil bath. Bearings Ball or Roller.

Large power saving — 3 h.p. only up to #8 gauge, or 5 h.p. for #6 gauge.

Fast spiral forming—Cushioned 'speed pick-up'.

Quick cut-off and netting advance—Instant, precise clutch action.

Entire "Cut-off" stop under ¾ second—Giving much more weaving time.

Fence rolled near operator — saves him half-mile daily—Gives more production time.

65% factory space saved—Machine only 3 ft. wide.

Constant, reliable and fully automatic operation—repairs almost never needed.

With Fifty years specialization on fence and Fence Machines, we have made this No. 2 A an ideal Chain-Link Fence Producer.

ARTHUR BLASHILL
WOODSTOCK,
ONTARIO, CANADA
(Formerly at Birmingham, England)

Cleveland Chain & Mfg. Co. Appointments

HENRY WEBER, affiliated with Cleveland Chain & Mfg. Co., Cleveland, for over 40 years, has been named general superintendent and production manager of its Fire Weld Division. He formerly was assistant to the late **Eli A. Round,** fire weld chain authority, who had been with Cleveland Chain 42 years. **Willis J. Keenan** has been placed in charge of a new district sales office opened in Philadelphia by Woodhouse Chain Works, Trenton, N. J., an associate concern. He formerly was affiliated with Bridgeport Chain & Mfg. Co., also an associate company of Cleveland Chain & Mfg. Co.

★ ★ ★

McInerney Spring & Wire Company Appointment

RUSSELL R. THOMPSON has returned to the **McInerney Spring & Wire Company,** Grand Rapids, Mich., as executive engineer in charge of design and development. He has more than 30 years' experience in the automotive industry, during which time he has devoted his time almost entirely to body-trim and the design and development of cushion spring construction. Immediately preceding World War II he was with McInerney Spring and Wire Co. as product engineer and liaison engineer with the company's customers.

★ ★ ★

Rome Cable Aquiring Andersen-Carlson Mfg. Co.

H. T. DYETT, chairman of the board of **Rome Cable Corporation,** announced that his company has acquired the assets of **Anderson-Carlson Manufacturing Company,** Torrance, Calif., and that final arrangements to complete the transaction will be completed shortly after the first of the year. Rome will acquire the assets of the company through an exchange of certain shares of Rome's common stock.

★ ★ ★

MR. DYETT also announced that the plant will continue under the direction of **Arthur A. Andersen,** president of the Andersen-Carlson Co., and **Gilbert Woodill,** executive secretary. No change in personnel is contemplated.

★ ★ ★

ANDERSEN - CARLSEN Company was incorporated in 1946 to manufacture electrical metallic tubing for the construction industry. It started production in October, 1948.

★ ★ ★

Northwestern Vice-President Retires

A. L. HAGLUND Executive Vice-President of **Northwestern Steel & Wire Company** of Sterling, Ill., has retired from active work because of ill health.

★ ★ ★

MR. Haglund has served Northwestern for a total of forty years, the last twenty-one of which were consecutive.

★ ★ ★

The **SPECIALISTS** in
Wire - Straightening and Wire - Cutting!

Diameter Range — 1/16" to .005"

PRECISION - Our Motto

DON'T hesitate to call on us when you are confronted with wire-straightening problems involving close tolerances and absolute accuracy. For seventeen years we have specialized in straightening and cutting all gauges of fine wire, hard or soft, ranging in diameter from one-sixteenth of an inch down to five-thousandths of an inch. We employ gun-barrel accuracy in straightening lengths from one inch to ten feet or any fractional part thereof. Ends cut absolutely clean without burrs.

ASK ABOUT OUR UNEXCELLED FACILITIES FOR CLEANING AND POINTING WIRE ALREADY STRAIGHTENED AND CUT.

ALL TYPES OF WIRE...

- Nickel
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- Bronze
- Brass
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- Alloy Wire
- Music Wire
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PITTSBURGH CUT WIRE COMPANY
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TELEPHONE: CEdar 4702

Dr. Walter A. Dew Addresses Los Angeles Electric Club

AT a meeting of the Los Angeles Electric Club honoring Tri-State Supply Corporations, **Dr. A. Dew,** manager of the Western District of the Extension Division of **E. I. duPont de Nemours and Company, Inc.,** addressed the gathering with a "Preview of Progress."

★ ★ ★

DR. DEW'S address highlighted many types of materials that are currently being perfected in the chemical laboratories of the nation, especially as they will affect the electrical and industrial industries.

★ ★ ★

TRI-STATE Supply Corporations, with warehouses in Los Angeles, San Francisco and Seattle, are currently marketing a complete line of Insulating Varnishes tradenamed Tri-Var which are compounded for them by duPont.

★ ★ ★

S. L. Manning Appointment Announced by Reynolds Metals Co.

S. L. MANNING has been appointed by **Reynolds Metals Co.,** Louisville, as assistant product manager for its Wire, Rod, Bar, Structurals and Cable Division. He joined the company in 1940, and during World War II was production manager of wire, rod, bar and fabrication in its merchant mill in Louisville. He also handled mill scheduling and the packing and shipping departments. He later was appointed sales manager of the Cleveland division sales office.

★ ★ ★

Cleveland Crane & Engineering Co. Announces

MILTON T. CARLETON has been appointed works manager of the **Cleveland Crane & Engineering Co.,** Wickliffe, Ohio. Mr. Carleton was formerly works manager of the Cleveland Div. of E. W. Bliss Co.

Fostoria Screw Co. Sold

A GROUP of five men has added to its industrial holdings by purchasing the **Fostoria Screw Company,** of Fostoria, Ohio. Members of the group are **Philip and Ben Moskowitz, Sidney G. Rose, Joseph Hoodin** and **Fred Weiland.**

★ ★ ★

THE Fostoria Screw Company, acquired from Bowser, Inc., of Fort Wayne, Ind., manufactures nuts, bolts, screws and gears for the automobile industry. The new owners plan to continue operation of the plant in its present location.

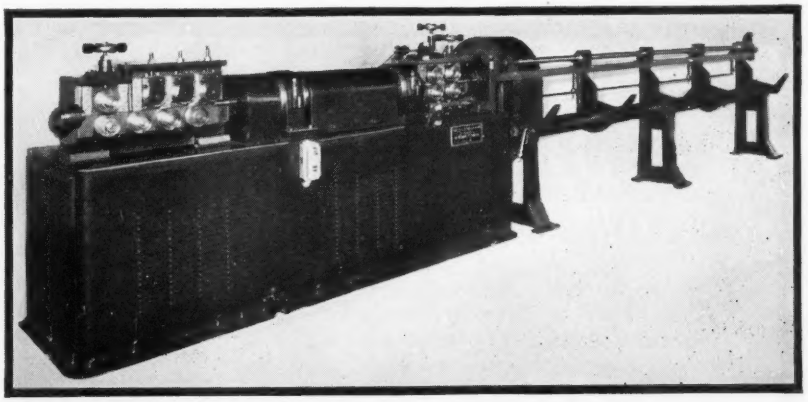
★ ★ ★

National Lead Fellowship Established

A NATIONAL Lead Fellowship in metallurgy has been established at the Missouri School of Mines and Metallurgy at Rolla, Mo., by the Titanium Alloy Manufacturing Division of the **National Lead Company** of Niagara Falls, N. Y., **Curtis L. Wilson,** Dean of

Type 3A
REDESIGNED
for
Greater Capacity

Type 3A now straightens wire from 1/4" - 1/2" dia., and 9/16" in soft stock. Type 4A (similar to illustration) handles diameters from 3/8" - 5/8", and 11/16" in soft stock.



Now Available **WIDEST RANGE STRAIGHTENERS BUILT!**

Here are some of the refinements developed during 50 years of specialization in wire straightening: ALMOST CONTINUOUS WIRE TRAVEL — LIGHTNING CUT-OFF THAT ASSURES SQUARE ENDS — HIGH SPEED, DIRECT-DRIVEN, 5-DIE STRAIGHTENING FLIER — QUIET, EFFICIENT V-BELT MOTOR DRIVE — BALL AND ROLLER BEARINGS THROUGHOUT — EXTREME RIGIDITY — CAPACITIES UP TO 11/16" DIAMETER.

Descriptive Folder Sent on Request

Mfd. by METTLER MACHINE TOOL, INC., 132W Lawrence St., New Haven, Conn.

SHUSTER *Automatic* *Since 1866*
WIRE STRAIGHTENING AND CUTTING MACHINES

the School, has announced. Holders of the fellowship may become candidates for the Doctor of Philosophy Degree.

★ ★ ★

A STIPEND of $1500 a year for a two-year period is provided, and, if the holder is a veteran, the stipend may supplement G. I. educational allowance. It will be available for the semester beginning January 30, 1950.

★ ★ ★

ACCORDING to officials of the company, it is hoped that the student accepting the assistance plan will select some phase of titanium metallurgy for research. Information may be obtained from Dr. A. W. Schlechten, head of the Metallurgy Department at the School.

★ ★ ★

Chemsteel Forms Industrial Furnace Affiliate

CREATION of a new associated company, **Affiliated Furnace & Engineering Inc.**, has been announced by **Charles E. Stone**, president of **Chemsteel Construction Co., Inc.**, Pittsburgh, Pa.

★ ★ ★

THE new affiliate will specialize in design, construction and maintenance of industrial furnaces. Offices will be maintained with Chemsteel at 5428 Walnut Street in Pittsburgh. Officers are: **Arthur M. Krieger,** president and general manager; **Clarence B. Avery,** vice president, engineering; **Merrill A. Stewart,** vice president, construction; and **Charles E. Stone,** secretary-treasurer.

★ ★ ★

MR. Krieger, who recently resigned as manager of the Estate Heatrola division of Noma Electric Corp., was previously associated with Universal Atlas Cement and Carnegie-Illinois Steel Corp. in construction, maintenance and operating divisions.

★ ★ ★

MR. Avery, also formerly associated with Carnegie-Illinois, has more recently been vice president, engineering for Chemsteel Construction Co., Inc.

★ ★ ★

MR. Stewart, another Carnegie-Illinois alumnus, was formerly construction superintendent for Chemsteel when the latter was an affiliate of Atlas Mineral Products Co., Mertztown, Pa. He is currently secretary-treasurer of Chemsteel, now an independent company specializing in design and installation of acid and alkali-proof construction.

★ ★ ★

MR. Stone formerly was general sales manager of Atlas Mineral Products.

★ ★ ★

Editor's Note

The Editor apologizes for the error which appeared on page 942 of the October, 1949, issue of WIRE & WIRE PRODUCTS. This page showed Mr. Carnahan as the Vice-President, Non-Ferrous Division of the Wire Association.

The Vice-President, Non-Ferrous Division of the Wire Association, elected at the 1949 meeting is RALPH B. ROTH, Vice-President and Secretary of the Ludlow-Saylor Wire Company of St. Louis, Missouri.

The Editor.

Controlled

OPERATING TEMPERATURES TO 650° F

The Royle Temperature Control Unit is designed to eliminate uncertainty in extrusion and other industrial processes which require accurate and constantly maintained operating temperatures of extended periods of time. This compact and simply operated unit will supply—or drain—heat in accordance with process specifications as established by laboratory experiments. Features are built into the self-contained Royle Temperature Control Unit to assure maximum results with a minimum of maintenance.

WRITE FOR COMPLETE DETAILS

JOHN ROYLE & SONS ROYLE PATERSON N. J.

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN 1880

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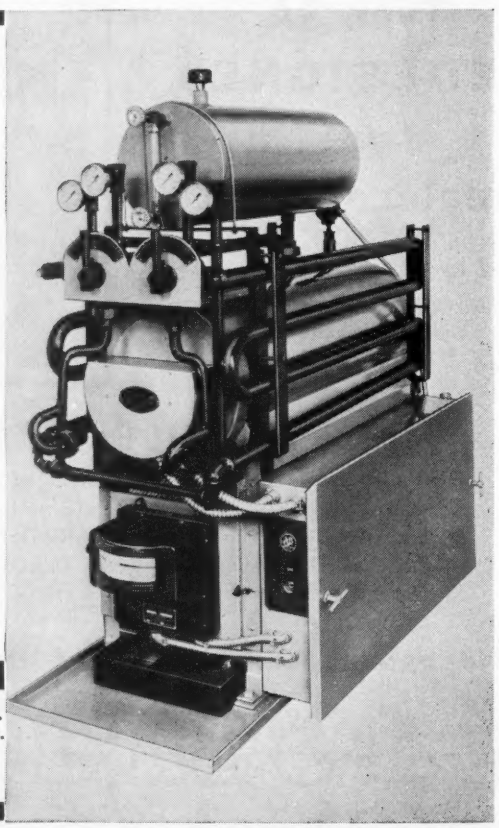
REgent 2430	SHerwood 2-8262	JEfferson 3264	LOgan 3261



A Review of Recent Wire Patents

NO. 2,480,860, APPARATUS FOR BENDING A CURLED METAL EDGE AROUND A REINFORCING WIRE, patented September 6, 1949, by Everett M. Hunt, Portsmouth, N. H.

A machine is provided to perform this operation on tin baking pans, for example.

★ ★ ★

NO. 2,481,108, BENT WIRE PUZZLE, patented September 6, 1949 by Albert J. Gore, Washington, D. C., assignor of forty-five per cent to Philip Larner Gore.

The device is composed of two lengths of bent wire.

★ ★ ★

NO. 2,481,313, ART OF WINDING COILS, patented September 6, 1949 by Harry V. Knauf, Jr., Oaklyn, N. J., assignor to Radio Corporation of America, a corporation of Delaware.

This method comprises winding the wire upon a coil form, with the wire provided with a dry coating of a synthetic resinous thermosetting adhesive, and subjecting this dry-coating to a temperature sufficiently high to render it tacky yet not so high as to thermoset it and, subsequent to the winding operation, subjecting the form-mounted coil to a temperature sufficiently high to completely thermoset the adhesive.

★ ★ ★

NO. 2,481,314, COIL-WINDING MACHINE, patented September 6, 1949 by Harry V. Knauf, Jr., Oaklyn, N. J., assignor to Radio Corporation of America, a corporation of Delaware.

The machine is adapted to wind the wire according to the preceding patent 2,481,313.

★ ★ ★

NO. 2,481,655, APPARATUS FOR LOCATING FAULTS IN CABLES, patented September 13, 1949 by Richard D. Gambrill, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

More specifically, the apparatus is for testing and locating faults which provide paths of reduced dielectric strength between the filamentary central conductor and the tubular conductor of a coaxial unit, including a calibrated potentiometer winding connected across the ends of the central conductor of a coaxial unit to be tested so as to form a parallel circuit therewith and means for impressing across the potentiometer winding and the tubular conductor of the coaxial unit a unidirectional potential having an intensity sufficient to break down the air dielectric between the conductors of the coaxial unit at a fault therein and cause a pulsating breakdown current to flow through the parallel circuit and form a Wheatstone bridge circuit.

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

★ ★ ★

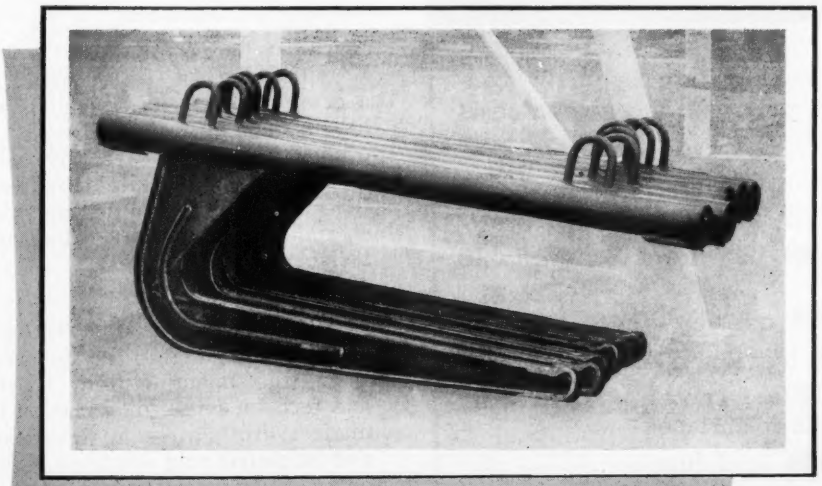
NO. 2,482,104, INHIBITED PHOSPHORIC ACID SOLUTION, patented September 20, 1949 by Frank E. Dolian, United States Army.

To protect ferrous metals from phosphoric acid corrosion, the inventor employs a 25% aqueous H_3PO_4 solution containing .1% as AS_2O_5 and .1% of 4-methyl-2-hydroxy quinoline.

★ ★ ★

NO. 2,482,241, METHOD FOR MAKING PRECOILED HELICAL FINS, patented September 20, 1949 by Ernest Bruegger, Massillon, Ohio, assignor to The Griscom-Russell Company, N. Y., a corporation of Delaware.

The fins are for engine cylinders and are of flat metallic ribbon and the method comprises continuously bending the ribbon edgewise around and in contact with a curved surface to form a helical coil and simultaneously bending the inner edge portion of the strip at an angle less than a right angle to the body of the strip, and then continuously further bending the bent inner edge portion of the coiled strip until it



designed for **HEAVY-DUTY** service . . .

WELDCO Lightweight *Hairpin* Hooks

● These Weldco lightweight Monel pickling hooks are now in use in a New York wire mill, where they replaced bulky, old-style equipment. The hooks are 10' 8" long, and handle up to 3,000 pounds each; they're so corrosion-resistant that, although they are used constantly in hot 7½% sulphuric acid, they outlast heavy cast hooks 2 to 3 times.

Wire mills throughout the country prefer Weldco hairpin hooks because of their lightweight, toughness, corrosion-resistance, and long service life.

Why not find out what these economical, heavy-duty pickling hooks can do for your plant? Write, phone, or wire us today.

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY

3736 OAKWOOD AVENUE YOUNGSTOWN 9, OHIO

is disposed normal to the body of the strip to form a continuous L-shaped foot portion along the inner edge of the coiled strip for engagement with a cylindrical surface surrounded by the fin.

★ ★ ★

NO. 2,482,259, HAIRPIN, patented September 20, 1948 by Robert N. Gernheuser, Toledo, Ohio, assignor to Gernheuser Industries, Inc., Toledo, Ohio, a corporation of Ohio.

A bobby pin of flat spring metal is provided, bent to form arms and grooves therein so disposed as to lessen broadside slippage of the pin when gripping the hair.

★ ★ ★

NO. 2,482,314, GAFF HOOK, patented September 20, 1949 by Clarence B. Beckwell, Superior, Wis.

The hook is constructed of a single length of heavy wire bent to form a hook, arms and an eye, so formed as to prevent the hook from slipping out of the hand.

★ ★ ★

NO. 2,482,869, SHIPPING PACKAGE FOR HEAVY SPOOLS, patented September 27, 1949 by Thomas R. Polglase, Spring Lake, and Henry J. Hoebeke, Muskegon, Mich., assignors to Anaconda Wire and Cable Company, a corporation of Delaware.

This package is adapted to contain a number (as eight) spools of wire.

★ ★ ★

NO. 2,482,883, WIRE TOOTH, patented September 27, 1949 by John H. Thomas, North Chicago, Ill., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

The tooth is one for use with agricultural machines and implements, as rakes.

★ ★ ★

NO. 2,482,978, METHOD OF MAKING COATED STEEL WIRE, patented September 27, 1949 by Antonio F. Ilacqua and John F. Occasione, Cleveland, Ohio, assignors to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

A method is provided to make coated steel wire which has a tensile strength of at least 290,000 pounds per square inch, a ductility sufficient to permit the wire to be bent flat upon itself without cracking the wire nor its coating, and a corrosion resistance sufficient to withstand over 300 hours salt spray test, and is capable of being stitched through two layers of structural steel each of a thickness equal to that of the wire.

★ ★ ★

NO. 2,483,186, APPARATUS FOR ROLLING SCREWS, patented September 27, 1949, by William A. De Vellier, New York, N. Y., assignor to New Process Screw Corporation, Waterville, Conn., a corporation of Delaware.

An apparatus is provided for successively rolling identically pointed double-thread screws.

★ ★ ★

New Oakite "Fume-Seal" Material for Acid Pickling Solutions

A NEW material, Oakite Composition No. 38, which produces a dense foam on acid pickling solutions and effectively seals in evolved gases, has recently been introduced by **Oakite Products, Inc.**, New York, manufacturers of specialized cleaning and allied materials.

★ ★ ★

THE compound is extremely stable in highly acidic solutions, the manufacturers report, and forms a dense foam blanket on nitric-hydrofluoric, hydrochloric, and sulphuric acid solutions which acts as an efficient seal against the escape of acid fumes. It is said to minimize the fuming of such bright dips as nitric-hydrofluoric acid on cast aluminum, nitric-sulphuric on brass and copper alloys at room temperature. By trapping fumes carrying acid drops before they leave the pickling tank, the compound is also said to minimize acid attack on exposed metal surfaces.

★ ★ ★

For Efficient Pickling
USE
Rodine®
The World's Standard Inhibitor...!

Rodine in the pickle bath—either batch or continuous—means improved pickling and lower costs because "Rodine" . . .

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"Rodine" more than pays for itself in savings of acid and metal.

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READERS desiring additional data regarding this new fume-seal material, without charge, should address Oakite Products, Inc., 152A Thames St., New York 6, N. Y.

★ ★ ★

Baldwin Cable Testing Machine Installed By General Cable

DESIGNED for tensile tests of multi-strand wire cable specimens up to 55 feet long between grips, a horizontal testing machine 74 feet long over-all, has been installed by **General Cable Corporation,** Bayonne, N. J. With the new machine, stress-strain characteristics of cables can be determined without unnatural effects that might be produced in tests of short lengths, particularly irregularities introduced at the ends of test specimens. Tests can now be made by one man instead of requiring three men, as before.

★ ★ ★

THIS machine, designed for loads up to 120,000 lbs., is being used mainly to record stress-strain curves automatically for power line conductors with strands of two metals. Tests are also applied to individual component strands under appropriate loads. These stress-strain relationships are the basis for the design of power lines and spans.

★ ★ ★

CABLES to be tested include copper stranded and HH hollow-core types as well as conductors composed of aluminum reinforced with steel cores in sizes up to 1,500,000 circular mils.

★ ★ ★

BALDWIN Locomotive Works, collaborating with its associated companies, A. H. Emery Co., Stamford, Conn., and O. S. Peters Co., Washington, D. C., designed and manufactured the machine.

★ ★ ★

Return-O-Tainer

A NEW shop or shipping container designed and built for intra-plant shipment of semi-processed and finished parts. These pallet boxes are also ideal for short or long distance transportation of bulk products.

★ ★ ★

POSITIVE-LOCKING, hinged sides fold flat for low cost return and small space storage. All steel, completely welded. Corrugated metal sides, ends and bottom, specially formed for strength of legs. Sizes: 40″ x 48″ x 24″ deep; Correct for crosswise loading in box cars and longitudinal loading in trucks.

FOR additional information, please write the **Fab-Weld Corporation,** Philadelphia 34, Pa.

★ ★ ★

Homer D. Heman

HOMER D. HEMAN, 73, who joined **Ajax Mfg. Co.,** Cleveland, in 1901, died Sept. 3. When he retired in 1948 he was vice president of the company, and he also had served as general manager.

★ ★ ★

ADAMAS draws your carbide die costs down!

COSTS... COSTS... COSTS... COSTS... COSTS... COSTS... COSTS... COSTS...

ADAMAS GIVES YOU ALL 5!

1. Increased output means
2. Longer die life means
3. Fewer rejections means
4. Easier maintenance means
5. Lower initial die price means

ECONOMY!

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Producers of top quality carbide for cutting tools, dies and wear resistance

Get ADAMAS DIE BULLETIN D-749 for full information on ADAMAS wire drawing dies, die nibs and wear parts for the wire industry.

The Waste Pickle Liquor Problem

(*Continued from page* 1044)

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1942 Swindin, N. British Patent Application 18,331.

1942 Feb. 3 Marek, L. F., U. S. Patent No. 2,271,524. Liquor evaporated to ferrous sulphate which is roasted to oxide of iron. Roast treated with ammonia gas and water to produce ammonium sulphate and iron oxide.

1943 Swindin, N. British Patent Application No. 17,278 (1943).

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1943 June 15 Hodge, W. W., U. S. Patent No. 2,322,134, June 15, 1943. "Process for Recovery of By-products from Waste Pickle Liquors." Precipitate Ferrous Sulphate by adding solution of water soluble ketone and separating precipitate.

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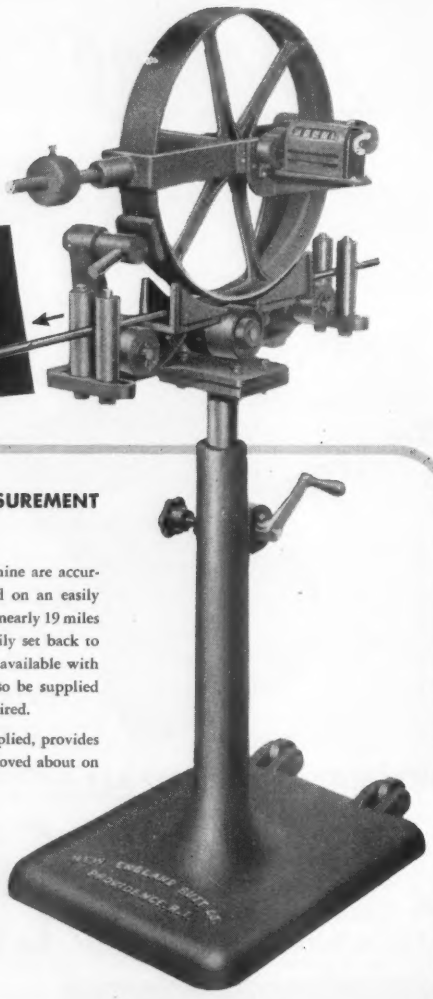
1944 May 2 Dean, W. T., U. S. Patent No. 2,347,891; May 2, 1944. A method of neutralizing waste pickle liquors involving bringing the pickle liquor and the neutralizing solution together at the intake of a centrifugal pump so that they are violently mixed, without lumping or clotting, during discharge.

1944 May 30 Carlsen, E. C., and Sharp, D. F., U.S. Patent No. 2,350,095; May 30, 1944. A method of neutralizing waste pickle liquor with a base solution to render the liquor fit for disposal. Mixing liquor and basic solution in central intake of centrifugal pump. Creates a smooth flow of a substantially neutral product fit for disposal.

1945 Jan. 2 Jan. 23 Urban, S. F., U. S. Patent No. 2,366,298. "Iron Recovery from Pickles." Solution put in an electrolytic tank with mercury cathode and insoluble anode with

NEBUTTCO

WIRE MEASURING MACHINES



FOR QUICK, ACCURATE MEASUREMENT OF WIRES OR CABLES . . .

Wires or cables passing through this machine are accurately measured and their lengths recorded on an easily read counter. Lengths up to 100,000 feet . . . nearly 19 miles . . . can be registered. Counter can be easily set back to zero at the start of a run. Machine is also available with counter mounted on right side. It can also be supplied with electric predetermined counter if desired.

Heavy cast iron standard, optionally supplied, provides firm support for machine, may be easily moved about on its rollers and adjusted to proper height by the rack and pinion. Machine illustrated is made in two sizes — No. 1 for measuring wires to 5/8" diameter and No. 2 for wires to 1½". We also manufacture a small bench type machine for measuring any flexible material not over 5/16" diameter.

For complete specifications ask for Circular No. 1

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12½% ammonium sulphate to increase rate of absorption of iron to mercury cathode. U. S. Pat. No. 2,367,811; Jan. 23, 1945.

1945 Nov. 27 Schumacker, E. A., and Heise, G. W., U. S. Patent No. 2,389,691; Nov. 27, 1945. Assignors to National Carbon Co., Inc. Electrolyzing acidulous aqueous solution of ferrous sulphate containing 0.5% to 5% free sulphuric acid to produce iron and a solution of ferric sulphate with mercury cathode.

1946 Apr. 8 Hodge, W. W., British Patent No. 576,501, April 8, 1946. "Reclaiming Waste Pickle Liquors."

1947 Feb. Dobson, John G., "Disposal of Cyanide Wastes." Metal Finishing February 1947, page 78. Eight Cyanide Waste Patents listed in references, p. 81.

1947 Apr. 15 Donroe, Louis J., Iron Plating (Deposition of Ferrous Sulphate) U. S. Patent No. 2,418,970. Metal Finishing, July 1947, page 90.

1947 May 13 Stoddard, William B., Jr., Electrodeposition of Iron (Ferrous Sulphate) U. S. Patent No. 2,420,403 Metal Finishing, July 1947, page 90.

1948 Kahn, James M., and Kominek, Jr. Edward. Assignor to Infilco, Inc. U. S. Patent No. 2,433,458. "Treatment of Pickle Liquor." Metal Finishing, April 1948, p. 86; Diagram of process.

The cyclic process for the treatment of waste pickle liquor containing free sulphuric acid, ferric sulphate, and ferrous sulphate, which comprises mixing magnesium hydroxide with said liquor to neutralize free acid and precipiate all of the ferric iron as ferric hydroxide and a minor portion of the ferrous iron as ferrous hydroxide, separating the resulting precipitate from said solution, adding calcium hydroxide to said liquor to precipiate the balance of the iron as ferrous hydroxide, thereby forming a mixed solution of calcium sulphate and magnesium sulphate, the liquor being kept sufficiently dilute to prevent precipitation of calcium sulphate therefrom, separating said solution from said ferrous hydroxide, adding dolomitic lime to said solution to precipitate magnesium hydroxide, and utilizing a portion of said magnesium hydroxide for the treatment of additional quantities of waste liquor.

1948 Allen, Louis N., Jr., and Zahray, Walter K., U. S. Patent No. 2,440,-215. "Treatment of Iron Sulfate Liquors." assignors to Chemical Contruction Company. Metal Finishing, August 1948, page 78.

1948 A method of treating ferrous sulphate liquor containing free sulphuric acid which compromises adjusting the acidity of said liquor to a pH within the range of from 2 to about 4.3 and reducing any ferric iron that may be present to the ferrous condition by adding to the liquor a metal above hydrogen in the electromotive force series of elements, heating the liquor to a temperature of at least 100 degrees C., subjecting the liquor to a settling process at said elevated temperature and thereby separating therefrom a ferrous sulphate sludge.

1948 Aug. 26 "Stream Pollution." The Iron Age, August 26, 1948, page 44.

1948 Sept. Martin, E. D., "Continuous Strip Pickling." Treatment of Waste Pickle Liquors, pages 1090-1091. Blast Furnace and Steel Plant, Sept. 1948, pp. 1090-1091.

1948 Sept. 30 Martin, Edwin D., "Regeneration System for Pickle Liquor." The Iron Age, September 30, 1948, pp. 60-63-66.

1948 Nov. Hoak, Richard D.; Lewis, Clifford J.; Sindlinger, Charles J.; and Klein, Bernice. "Pickle Liquor Neutralization." Industrial and Engineering Chemistry Vol. 40, p. 2062, November 1948.

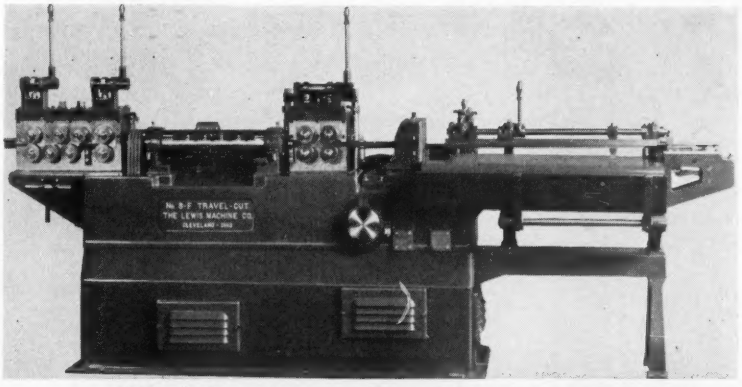
1949 Jan. 2 "Disposal Unit, Finest in Nation to Be Ready for Use in 1950." News Feature Section, Los Angeles Examiner, Sunday, January 2, 1949.

1949 Jan. 20 Lewis C. J., "Dry Lime Treatment of Waste Pickle Liquor." The Iron Age, January 20, 1949, pp. 49-53.

Part II of this article will be published in the December, 1949 issue of WIRE AND WIRE PRODUCTS.

CUT YOUR CUTTING COST WITH

LEWIS TRAVEL-CUT



Wire Straightening & Cutting Machines

The simplicity of design and rigid construction of the Lewis Travel-Cut makes it well suited for the most severe high-production requirements. This machine feeds the wire from the coil, straightens, gauges to accurate length, and cuts while in motion thus producing uniform diameter rod free of arbor swell and feed roll marks. It is particularly adapted to precision work on bright finished steel, brass, aluminum, stainless, and alloy wire. This method of cutting is also very efficient for short lengths such as welding rod, special bolts, etc., and increases the over-all efficiency approximately 20% over the conventional type of cut-off.

Machines built in various sizes to handle from 1/16" up to 3/4" diameter, and 1/16" to 5/8" square or equivalent area in hexagon and flat.

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CENTRAL: Moslo Machinery Company, 2443 Prospect Avenue, Cleveland 15, Ohio.

CANADIAN: Empire Engineering Company, 11 Wellington Street East, Toronto 1, Ontario.

CONTINENTAL EUROPE: Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London S.W. 11, England.

Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne.

The LEWIS MACHINE Co.
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CLEVELAND, OHIO

Hauck Issues New Burner Catalog

A NEW 8-page Catalog No. 409, recently off the press, is available for distribution from the **Hauck Manufacturing Co.**, 124 Tenth St., Brooklyn 15, N. Y.

★ ★ ★

IT should be of interest to any industrial plant burning oil (or combination oil and gas) in metallurgical, ceramic, glass, chemical, asphalt and other heat processing applications.

★ ★ ★

THE superior performance of the burner helps to reduce production and fuel costs. Major advantages are given on page 1.

★ ★ ★

Reynolds Signs Contracts with Converters for Immediate Production of Electric Cable

CONTRACTS signed with three converting plants will enable the **Reynolds Metals Company** to deliver a minimum of 13,500,000 pounds of Aluminum Cable, Steel Reinforced (ACSR) to rural electric cooperatives of the nation in 1949, David P. Reynolds, the company's vice-president and general sales manager, has announced.

★ ★ ★

MR. REYNOLDS said that firms contracting with Reynolds to produce the new cable are the Bergen Wire Rope Company, Lodi, New Jersey; Midland Wire Corporation, Tiffin, Ohio; and the Southern Electrical Corporation, Chattanooga, Tennessee.

★ ★ ★

REYNOLDS will supply coiled aluminum wire and rod to the three firms for production of ACSR conductor. Entire output has been contracted for by the Wisconsin Electric Cooperative for distribution to REA sponsored rural electric cooperatives all over the country.

★ ★ ★

THESE contracts for production of ACSR along with the interim sales contract recently signed with the Wisconsin cooperative will enable Reynolds to supply conductor immediately, instead of beginning in 1950 as originally planned. In addition, Reynolds existing facilities will produce a portion of this cable.

★ ★ ★

REA OFFICIALS estimate that 27,000 miles of rural power line poles are now standing awaiting installation of this aluminum cable.

★ ★ ★

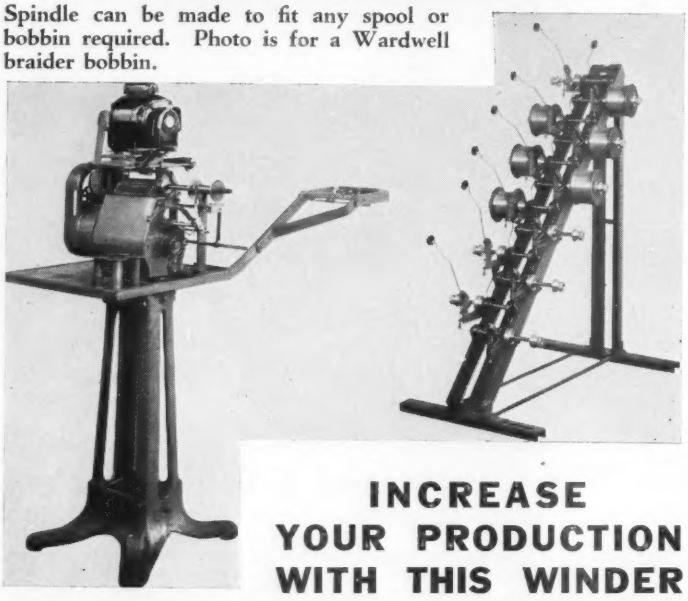
Tests Show Heat Stability Of Polymeric Plasticizers

A RECENT aging study has dramatized the stability under continued high heat of two members of the Paraplex series of polymeric plasticizers—G-25 and G-50. Tests were conducted in the laboratories of **The Resinous Products Division of Rohm & Haas Co.** to determine the adaptability of these resins as plasticizers for vinyl compounds used in wire insulation subjected to high temperatures.

★ ★ ★

STANDARD UNI-DRIVE WIRE WINDER

Spindle can be made to fit any spool or bobbin required. Photo is for a Wardwell braider bobbin.



INCREASE YOUR PRODUCTION WITH THIS WINDER

Main drive belts done away with. Traverse variation from 1⅝" to 5½" between heads without changing cam. Equipped with ¼" H. P. A. C. motor for 110 volts, 60 cycle current, single phase. Incorporates many valuable new features. Winds up to 24 ends on each spool. New micrometer variable traverse motion winds evenly between heads. Geared wind produces straight parallel wind which eliminates jumping of guide on braider latch. Starts slow. Makes possible greatly increased production.

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A SERIES of Paraplex G-25 and Paraplex G-50 stocks was aged for five and 12 days at 120 C. and evaluated for retension of physical properties, using tensile strength and ultimate elongation as criteria of heat stability. Obviously, such a test measures volatility as much as heat stability: any loss of plasticizer will appear as a change in tensile and elongation values.

★ ★ ★

TABLE I gives the compounding recipe and procedure for the two vinyl stocks. Table II demonstrates the exceptional stability of both stocks. After 12 days' aging at 120 C. neither stock showed substantial changes in percent elongation nor tensile strength, a degree of stability not approached by monomeric plasticizers included in the test. Stocks in which these monomeric esters were used were too brittle to be tested after five days' aging. It appears that their inherent volatility is partially responsible for their failure at high temperatures.

★ ★ ★

TABLE I

FORMULATIONS AND MILLING CONDITIONS

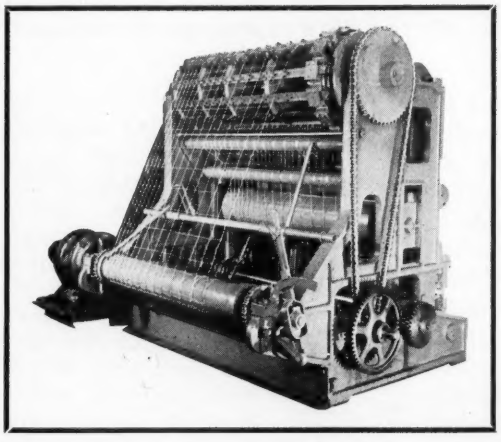
Compound	A	B
Geon 101	60 parts	60 parts
Paraplex G-25	40	----
Paraplex G-50	----	40
Basic Lead Carbonate	5	5
Stearic Acid	0.5	----
Total Mixing Time	12 min.	11 min.
Banbury Steam Pressure	60#/sq. in.	60#/sq. in.
Banbury Temperature	310°F.	310° F.
Milling Time	5 min.	5 min.
Milling Temperature	300°F.	300°F.

TABLE II

PHYSICAL TEST RESULTS

	Original		5-days' Aging at 120°F.		12-days' Aging at 120°C.	
	% Elong.	Tensile (psi)	% Elong.	Tensile (psi)	% Elong.	Tensile (psi)
A	250	2180	290	2350	290	2100
B	320	2350	320	2420	300	2240

INTERLOCKING FENCE LOOMS



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- Wrapped Stay—Farm Or Poultry Fence.
- Fastest In The Industry.
- Cuts 135 To 145 Stays Per Minute.
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SOLE MAKERS OF WILLEY'S METAL

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New Stainless Steel Announced by Armco

AN unusual combination of advantages is provided in a new grade of stainless steel developed by **Armco Steel Corporation,** Middletown, Ohio. Called Armco 17-4 PH Stainless Steel, this alloy has high hardness and strength, excellent corrosion resistance, good fabrication characteristics, and requires only a low temperature (850 to 1000°F.) hardening treatment. It is recommended especially for gears, cams, shafting, chains, valves and pump parts in equipment where high mechanical properties and corrosion resistance better than can be obtained with present standard hardenable grades are necessary. A wide range of possible applications for this alloy is indicated.

★ ★ ★

CONTAINING 17% chromium, 4% nickel and 4% copper, Armco 17-4 PH Stainless Steel has a corrosion resistance superior to that of the standard hardenable alloys and approaching that of 18-8. Hardness values of Rockwell C40 to 45, with high tensile and yield strength, are obtained by precipitation hardening. This merely requires heating the annealed material to approximately 900°F. for about one hour and air cooling.

★ ★ ★

THE low hardening temperature, instead of the high temperatures used with standard hardenable stainless steels, eliminates problems such as quenching cracks, distortion, internal stresses and objectionable scaling. Since only an easily removed surface discoloration is produced in the precipitation hardening of Armco 17-4 PH Stainless Steel, parts can be finish machined before hardening. This eliminates expensive grinding or finish machining normally required after heat treatment.

★ ★ ★

THIS new Armco product can be readily hot-forged and has good machining and welding properties. Armco 17-4 PH Stainless

Steel is available as bar and wire in either the annealed or hardened condition.

★ ★ ★

Case Histories on Silicone Resins Given

THE DOW CORNING CORPORATION, Midland, Mich., in the current issue of Silicone News gives case histories of five instances where silicone electrical insulation has shown unusual life.

★ ★ ★

THIS material is said to give motors ten times normal life expectancy and ten times the wet insulation resistance of Class B insulating compounds. This is largely because the Dow Corning material will withstand continuous operating temperatures of 200°C.

★ ★ ★

HIGH-TEMPERATURE Silicone greases will also contribute to satisfactory operation at above average temperatures.

★ ★ ★

DETAILS regarding these materials will be furnished by the company at Midland or any of its branches.

★ ★ ★

Reynolds Offers Re-draw Rod To Wire Industry

REYNOLDS METALS COMPANY is now offering ⅜" diameter aluminum re-draw rod coils in two alloys—EC and 61S.

★ ★ ★

COILED aluminum re-draw rod is used primarily by large producers of wire who draw the material into smaller diameter wire sizes. The material is available from the Reynolds Alabama rod mill at Listerhill, Ala., in 150-lb. coils. Coils are 48" O.D., 36" I.D., with rod diameter tolerances plus or minus 1/64".

★ ★ ★

THE material is being supplied in the following alloys and tempers: EC-H16, EC-H12, EC-0, 61S-F, and 61S-0.

★ ★ ★

Yarns for Electric Wire

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STATEMENT OF OWNERSHIP, management, circulation, etc., required by the Acts of Congress of August 24, 1912 and March 3, 1933, of Wire & Wire Products published monthly at Jersey City, N. J., for October 1, 1949.

State of Connecticut, County of Fairfield, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared Richard E. Brown, who, having been duly sworn according to law, deposes and says that he is the President of Wire & Wire Products and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Quinn-Brown Publishing Corporation, 300 Main St., Stamford, Conn.; editor, Richard E. Brown, 300 Main St., Stamford, Conn.; managing editor, none; business manager, Ruth S. Spengel, 300 Main St., Stamford, Conn.

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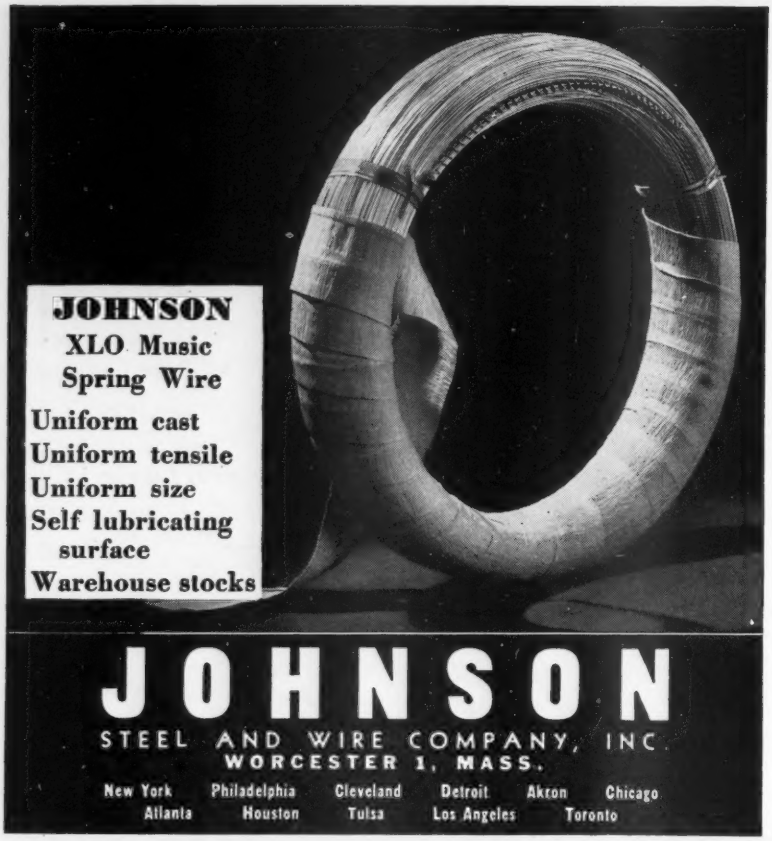
RICHARD E. BROWN
(Publisher)

Sworn to and subscribed before me this 9th day of September, 1949.

GEORGE W. VEIT,
Notary Public.

My commission expires April 1, 1952



GENERALLY where EC 3/8" diameter rod is drawn to finished wire sizes .135" diameter and larger, EC-H16 rod is employed. Where EC3/8" diameter rod is drawn to finished wire sizes between .077" and .135" diameter, EC-H12 rod is recommended.

Bulletin on Dies

"WITH Carboloy's Five Aces" is the title of a new Bulletin issued by the **Carboloy Company, Inc.,** Detroit, Michigan. It describes and illustrates the five services that are offered by the company to customers. You are invited to write for your copy.

★ ★ ★

Round Edge Flat Wire Announced

AMERICAN NICKELOID COMPANY, Peru, Ill., has recently announced the availability of Round Edge Flat Wire. Furnished in Nickel or Chrome finish on steel base, this material finds wide usage among manufacturers in such decorative and functional uses as trim, furniture parts, toys, trunk hardware, displays, and in pin ball machines.

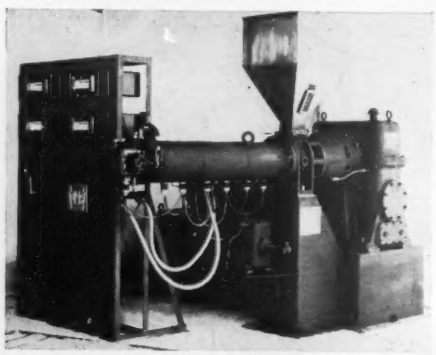
★ ★ ★

KNOWN for its smooth edges, narrow widths, heavy gauges and rigidity, Round Edge Flat Wire is available finished on one or both sides. It is furnished in .035" to .125" thickness, and 3/16" to 2" widths. Standard length in Nickel finish is 71" or 142" cut into two parts, no one part exceeding 95". In Chrome finish, lengths are 70" or 140" cut into two parts, no one part exceeding 94".

★ ★ ★

INQUIRIES may be directed to American Nickeloid's home office in Peru, Ill., or to any of its sales offices located in all principal cities.

★ ★ ★



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Continuous Strand Cleaning and Coating of High Carbon Rods and Wire

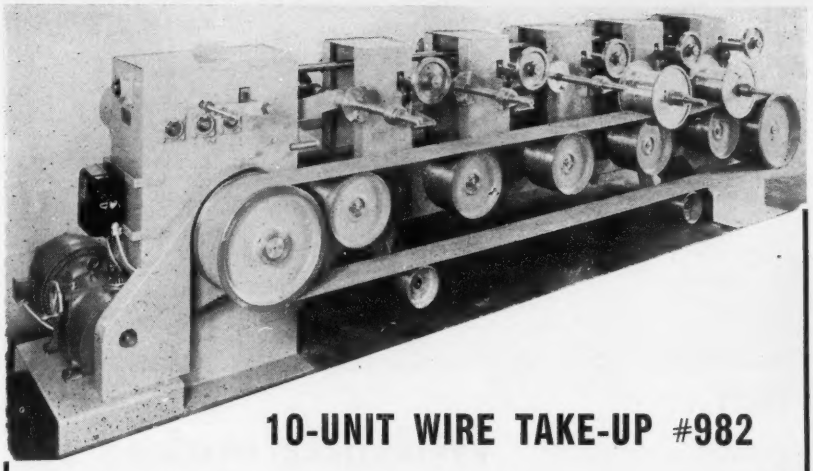
(*Continued from page* 1038)

tioned compounds used singly in strand coating have not met with consistent success in subsequent wire drawing operations. However, preliminary investigations have indicated that combinations of these compounds exhibit some promise in achieving the desired coating characteristics. For the most part, the combinations used have involved the application of a lime-substitute as a base coating immediately followed by immersion in a lime bath. For example, one wire plant has reported some success in strand coating by immersing the wires in a phosphate solution and thence into two lime baths with hot air drying after each lime immersion. The multiple lime dips were found necessary to provide sufficient coating for satisfactory wire drawing. The phosphate, it was reported, not only supplemented the lime as a coating with regard to amount, but was also more effective than the plain steel base in holding the lime intact on the wire.

★ ★ ★

WHETHER lime-substitutes can be developed to the point where they can be used singly, or whether they must be used in combination with lime to accomplish successful strand coating, the element of time required to do the job is the governing factor. Time must be ultimately translated into the straight-line space required to accomplish the desired end result. It has been mentioned previously that straight-line footage comes at a high premium in most plants and is sadly lacking in many others. Strand coating, therefore, must be carried out in as short a time and space as possible, consistent with good coating characteristics. Some plants using lime and lime-substitutes in combination have been reported to be satisfactorily coating wires .090" and under in 15 to 30 feet of space with the quality of the finished wire being equivalent to or superior to batch cleaned and coated product.

★ ★ ★



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Variable-speed belt type, suitable for 12" and smaller diameter reels.
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Reel retainers with quick-acting lock and release.
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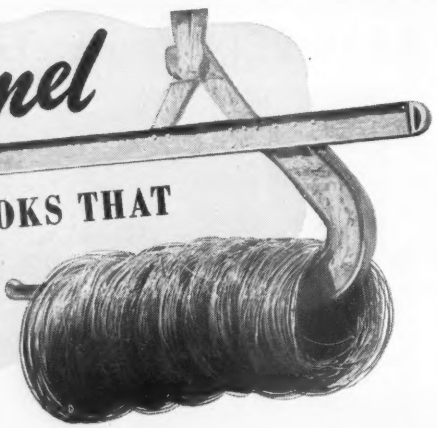

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FROM wire drawing results and improved quality obtained experimentally using some lime-substitutes in batch cleaning, it has been hoped that these compounds could be employed without the use of lime in strand coating. However, to obtain a satisfactory coating in sufficient quantity, generally a minimum of 2 minutes immersion time in the solution is required. Translating this time factor into the straight line distance required to deposit an equivalent amount of coating in the strand process would involve, for example, a coating tank 100 feet long for size .060" wire running at a patenting speed of 50 FPM. Such a space requirement would be prohibitive. One method which might be suggested for reducing this space would be to utilize vertical distance by constructing a deep tank equipped with top and bottom sheaves and thus employ multiple vertical passes throughout the solution. This idea, however, would be attended by many tracking and maintenance problems.

★ ★ ★

THE matter of immersion time in strand coating presents a challenge to the manufacturers of lime-substitutes and there are current indications that these people have started to work on the problem. In order to attack this problem, a logical question would be: how much coating must be deposited on the wire and what maximum immersion time can be tolerated? This is, of course, a difficult question to answer for the wire industry as a whole and would depend on individual plant practices and the particular lime-substitute to be considered. However, as merely an indication, it would be well to mention that one plant experimenting with phosphate compounds has developed through wire drawing tests that a minimum phosphate coating weight of 140 milligrams per square foot of wire surface will permit drawing quality wire at high speeds. They would desire, in their particular set-up, to be able to deposit this amount of coating in an immersion time of not greater than 25 seconds. While these re-

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sults are preliminary only and cannot be considered conclusive, they may, along with additional investigative work, aid in setting goals at which lime-substitute manufacturers can aim.

★ ★ ★

Conclusion

AN attempt has been made in this paper to summarize, in a general way, the potential advantages and the industry-wide status of continuous strand cleaning and coating of rods and wire in tandem with the patent annealing operation. It should be understood that this process is largely in the experimental stages and results obtained to date cannot be considered conclusive. Therefore, factual data, always most helpful in a technical discussion, are either lacking or not available. It is hoped, however, that this resume will have helped to stimulate thinking and investigation on the subject, so that at some future date a more complete picture of the process can be presented.

★ ★ ★

IN summary, the following points should be emphasized:

(1) The process described herein presents definite potentialities with regard to improved quality high carbon wire and lower costs.

(2) Shot blasting and brush cleaning are mechanical strand descaling methods worthy of consideration.

(3) Strand descaling has been successfully accomplished employing acid solutions.

(4) Lime used in combination with lime-substitutes shows promise in strand coating.

(5) In general lime-substitutes used singly in strand cleaning require excessive immersion time, thereby requiring a prohibitive amount of straight line space.

★ ★ ★

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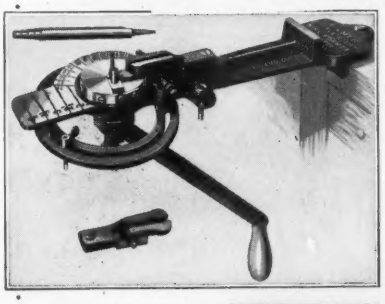

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Tin Coatings in the Wire Industry

(*Continued from page* 1032)

IT should be pointed out that the familiar tin crystals—hydrated stannous chloride of commerce—is not useful in the process. The salt must be the anhydrous variety, which is obtainable commercially under the trade name "Stannochlor".

★ ★ ★

THIS fused salt process appears to offer an attractive compromise between hot dipping and electroplating. It shares with hot-dip the advantages of simplicity of apparatus and the production of a bright coating; and with electroplating the possibility of close control over the amount of tin deposited.

★ ★ ★

IT cannot yet be offered to the trade as a going commercial proposition, for several problems remain to be worked out. It can be said that the fundamentals have been well studied in the work already mentioned by Gonser, and the economics and more practical considerations are at present under investigation in our laboratories.

★ ★ ★

PRESENT indications are that the process should be attractive for the coating of fabricated articles like cake coolers, coarse mesh and the like, since build-up of tin at the cross-overs is almost entirely eliminated. Its status for the continuous coating of wire is at present an unknown quantity.

★ ★ ★

Conclusion

THE attractiveness of electroplating tin on wire as an alternative to hot dipping has been pointed out and several possible baths have been briefly mentioned. The potassium stannate bath has been more fully described, in the belief that it is probably best adapted to the high speed plating of continuous coils of wire. The principal advantages of the electroplating process are seen to be economy of tin and a greater de-

gree of control over the final product.

* * *

THE molten salt immersion process is discussed briefly to indicate the status of the work now going on to investigate this promising method.

* * *

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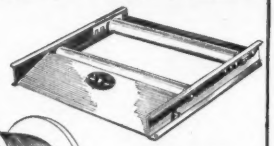

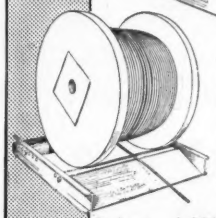

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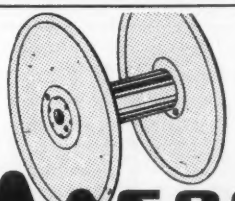
* * *



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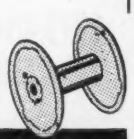

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Roebling Opens Office and Warehouse in Cincinnati

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., nationally-known manufacturers of wire products, announces that a new office and warehouse has been opened at Cincinnati, Ohio.

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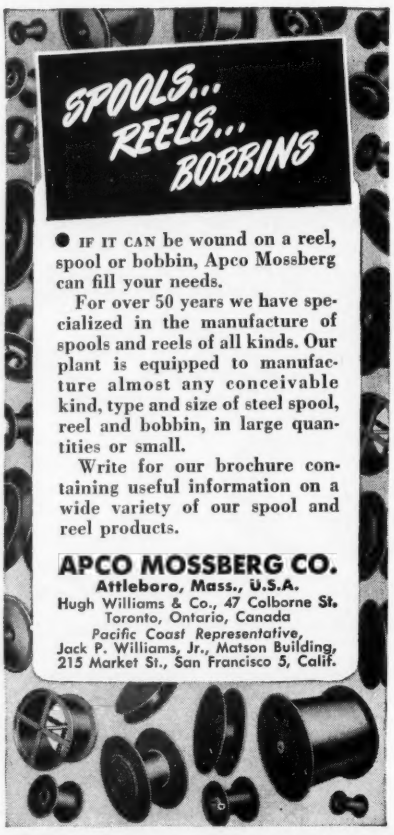

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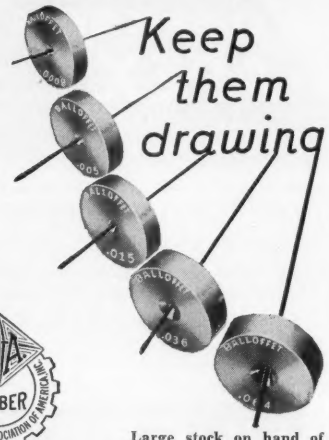

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* * *

FURTHER information may be obtained from **Dr. A. W. Schlechten,** Chairman, Dept. of Metallurgical Engineering, Missouri School of Mines and Metallurgy, Rolla, Missouri.

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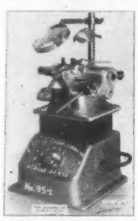

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Use of New, Low-Cost Fiberglas Yarns Cuts Cost of Electrical Tapes

WEAVERS of electrical insulation tapes woven of Fiberglas yarns have completed experimental weaving of the new, low-cost 150's Fiberglas yarns for most of the standard electrical tapes, according to **J. H. Thomas,** vice president of **Owens-Corning Fiberglas Corporation,** and general manager of its Textile Products Division.

★ ★ ★

THESE new low-cost tapes are designed to supplement the standard widely-used constructions now available. It is anticipated that they will open up new markets for those applications where the premium quality characteristics of Fiberglas tapes have been foregone in favor of organic tapes because of price differential.

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For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyer's Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION
Atlas Mineral Products Co., Mertztown, Pa.
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy., Inc., Pawtucket, R. I.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Morgan Construction Co., Worcester, Mass.
Ross, J. O., Engr. Corp., New York, N. Y.

BAR STOCK—Stainless Steel
Armco Steel Corp., The, Middletown, Ohio.
American Steel & Wire Company, Cleveland Chicago, New York.
Columbia Steel Co., San Francisco, Calif
U. S. Steel Export Company, New York, N. Y.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

BORAX—Wire Drawing
Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N.J.

CEMENTS—Acid Proof
Atlas Mineral Products Co., Mertztown, Pa.
Sauereisen Cements Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.
Sauereisen Cements Co., Pittsburgh, Pa.

CHEMICALS—Cleaning
(See Cleaners—Metal)

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corp., Brooklyn, N. Y.
Metal & Thermit Corp., New York, N. Y.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Division, Colorado Fuel & Iron Corp., Buffalo, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J. Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

COLD HEADERS—
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Diamond
Eastern Carbide Corp., New Rochelle, N. Y.
Hyprez Division, Engis Equipment Co., Chicago, Ill.
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Pacific Coast Borax Corp., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Inc., Chicago, Ill.
Swift & Company, Chicago, Ill.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, New York.
Vascoloy-Ramet Corp., North Chicago, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Champion Diamond Co., New York, N. Y.
Diamond Distributors, Inc., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Champion Diamond Co., New York, N. Y.
Diamond Distributors, Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Division, Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Carboloy Co., Inc., Detroit, Mich.
Champion Diamond Co., New York, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide
(See Dies—Tungsten Carbide)

DIES—Cold Heading
Adamas, Carbide Corporation, Harrison, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Champion Diamond Co., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Adamas, Carbide Corporation, Harrison, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Eyelet
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Adamas, Carbide Corporation, Harrison, N. J.
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Detroit, Mich.
Champion Diamond Co., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Special Shapes, Etc.
Adamas, Carbide Corporation, Harrison, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Tantalum Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tube Drawing
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.

WHERE TO BUY, Continued

Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Flange Steel
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., The, Paterson, N. J.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting Hot Galvanizing
Wallace G. Imhoff Co., The, Los Angeles, Calif.

ENGINEERS—Consulting Spring Design
Carlson, Co., The, New York, N.Y.

ENGINEERS—Consulting Wire Mill
Fisher, Edward J. P., North Jackson, Ohio.
Lewis, Kenneth B., Worcester, Mass.
Wickwire, T. H. Jr., Philadelphia, Pa.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland. Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co. Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Co., Inc., Philadelphia, Pa.

FURNACES—Resistance Heating, Strand
Trauwood Engineering Co., Cleveland, Ohio.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
General Electric Co., Schenectady, N. Y.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOOKS—Pickling and Liming
Youngstown Welding & Engineering Co., Youngstown, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Belding, Heminway, Corticelli Co., New York, N. Y.
Du Pont de Nemours, E. I., Co., Wilmington, Del.
Martin, Glenn L., Company, Baltimore, Md.
Owens Corning Fiberglas Corp., Toledo, O.
Twitchell, E. W., Philadelphia, Pa.

INSULATING MATERIALS—Paper—For Electric Wire Cable.
Twitchell, E. W., Philadelphia, Pa.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Roos, Tool & Mfg. Co., Montclair, N. J.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, for lagging and car blocking.
North Anson Reel Co., North Anson, Maine

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wean Engineering Co., Cleveland, Ohio.

MACHINERY—Bead Wrapping
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Eisler Engineering Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co,, The, Bridgeport, Conn.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coilers
Boyd & Sons Manufacturing Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (used), New York, N. Y.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Machinery, Inc., Pawtucket, R. I.

WHERE TO BUY, Continued

MACHINERY—Cold Heading
(See Cold Headers)

MACHINERY—Copper Wire Drawing and Rolling
Aetna-Standard Engineering Co., Youngstown, Ohio.
American Insulating Mach'y Co., Phila., Pa.
National Machinery Exchange (used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool, Inc., New Haven, Conn.
National Mach'y Exch. (Used) New York, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Roos, Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wickman, A. C., Ltd. Coventry, England.

MACHINERY—Draw Benches
Aetna-Standard Engineering Co., Youngstown, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
National Erie Co., Erie, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Fence
Blashill, Arthur, Woodstock, Ont., Canada.
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
National Erie Co., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R.I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Engineering Company, Youngstown, Ohio.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Youngstown, Ohio.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber Insulating
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila, Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Boyd & Sons Manufacturing Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
National Mach'y Exch. (Used), New York, N.Y
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Forming
Wickman, A. C., Ltd., Coventry, England.

MACHINERY—Strip Steel
Aetna-Standard Engineering Co., Youngstown, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Erie Corp., Erie, Pa.
National Mach'y Exch. (Used), New York, N.Y
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co. Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Testing Physical
Eberbach & Son Co., Ann Arbor, Mich.
Scott Testers, Inc., Providence, R. I.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Co., Cleveland, Ohio.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

WHERE TO BUY, Continued

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply, Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna-Standard Engineering Co., Youngstown, Ohio.
Davis, R. L. Electric Co., Wallingford, Conn.
General Electric Co., Schenectady, N. Y.
Industrial Ovens, Inc., Cleveland, Ohio.
Standard Machinery Co., Mystic, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio.

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Youngstown, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co. Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Kilmer, M. D. & Co., Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Wickman, A. C., Ltd., Coventry, England.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N.Y.

MACHINERY—Wrapping Straight Lengths and Tubing
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Wrapping Wire Coils
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
U. S. Steel Export Co., New York, N. Y.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
General Electric Co., Schenectady, N. Y.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Pa.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Engineering Company, Youngstown, Ohio.

PICKLING TANK LININGS—
Atlas Mineral Products Co., Mertztown, Pa.
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PNEUMATIC CYLINDERS
Entwistle, James L. Co., Pawtucket, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Mystic, Conn.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Pa.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STANDS—
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Roll-a-Reel, Cincinnati, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Roll-a-Reel, Cincinnati, Ohio.
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Drawn Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Chicago, Ill.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS & SPOOLS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS & SPOOLS—Plastic
Hubbard Spool Company, Chicago, Ill.

REELS & SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Clark, J. L., Mfg., Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
North Anson Reel Co, North Anson, Maine.

REELS—Metal Bound
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
North Anson Reel Co., North Anson, Maine.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

WHERE TO BUY, Continued

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Nickel Alloy
Eastwood Nealley Corp. Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio.
Armco Steel Corp., The, Middletown, Ohio.

RODS—Wire—Non-Ferrous
Eastwood Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Roebling's John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel, Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc., Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Inc., Chicago, Ill.
Swift & Company, Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANKS—Compound
Atlas Mineral Products Co. of Pa., Mertztown, Pa.
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Chemsteel Construction Co., Pittsburgh, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Pa.

TINSEL—Cords, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Electric Conductor
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Electric Resistance
(See: Tinsel—Electric Conductor)

TINSEL—Lame, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Decorative
(See: Tinsel—Electric Conductor)

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

TUBE BENDERS AND FORMERS—
H. D. Kilmer Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila., Pa.
Davis R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Barbed
Interlocking Fence Co., Morton, Ill.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland-Chicago, New York.
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Co., Inc., New York, New York
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland-Chicago, New York.
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div. of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Steel & Wire Co., Cleveland-Chicago, New York
Columbia Steel Co., San Francisco, Calif.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE—Nickel & Nickel Alloy
Eastwood-Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

WIRE—Nickel Silver and Phosphor Bronze
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., New York, New York.

WIRE—Spring
American Steel & Wire Co., Cleveland-Chicago, New York.
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Indiana.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
U.S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland-Chicago, New York
Armco Steel Corp., The, Middletown, Ohio.
Columbia Steel Co., San Francisco, Calif.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting—
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

YARNS & TAPES—
Belding, Heminway, Corticelli Co., New York, N. Y.
Du Pont de Nemours, E. I., Co., Wilmington, Delaware
Owens Corning Fiberglas Corp., Toledo, Ohio.
Twitchell, E. W., Philadelphia, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

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SERVING HEADS. Concentric and eccentric, many designs, for threads, asbestos, etc.

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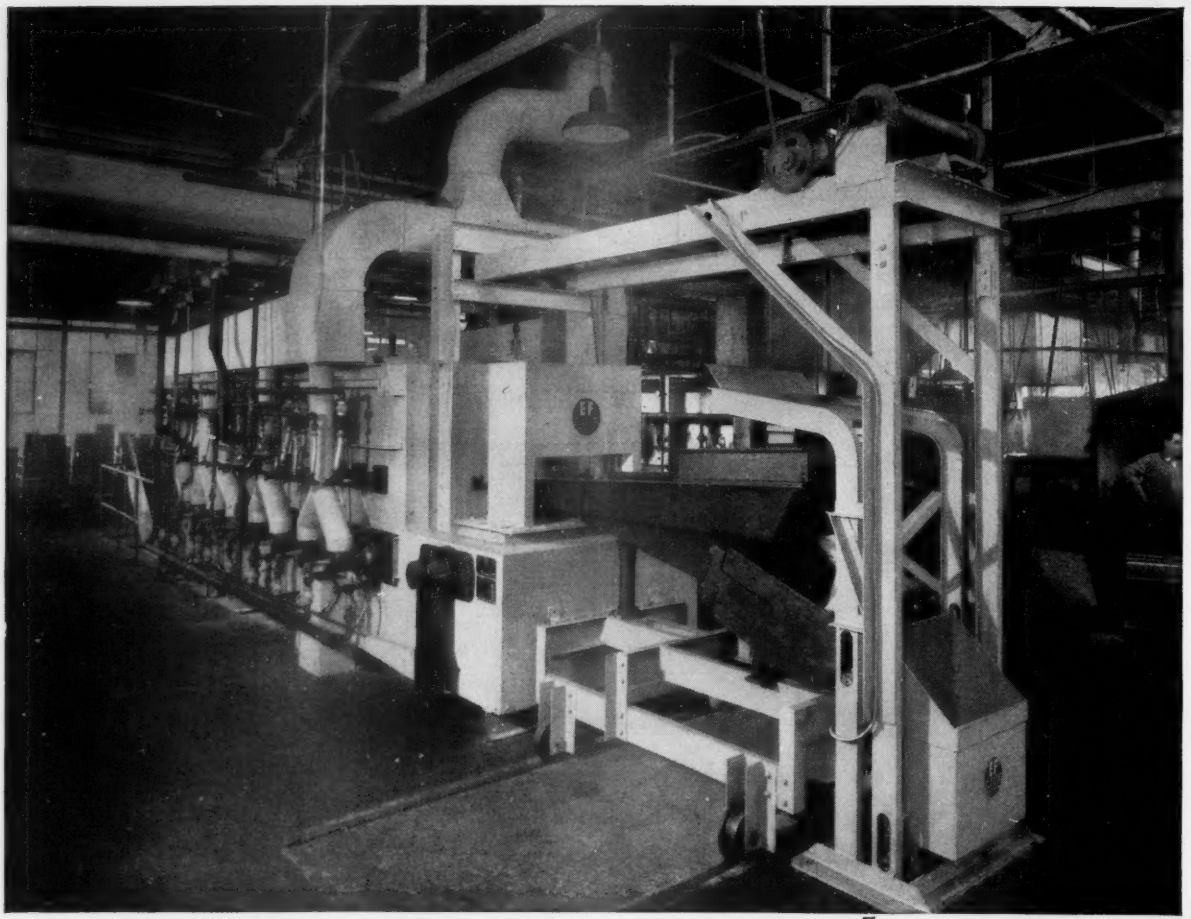

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